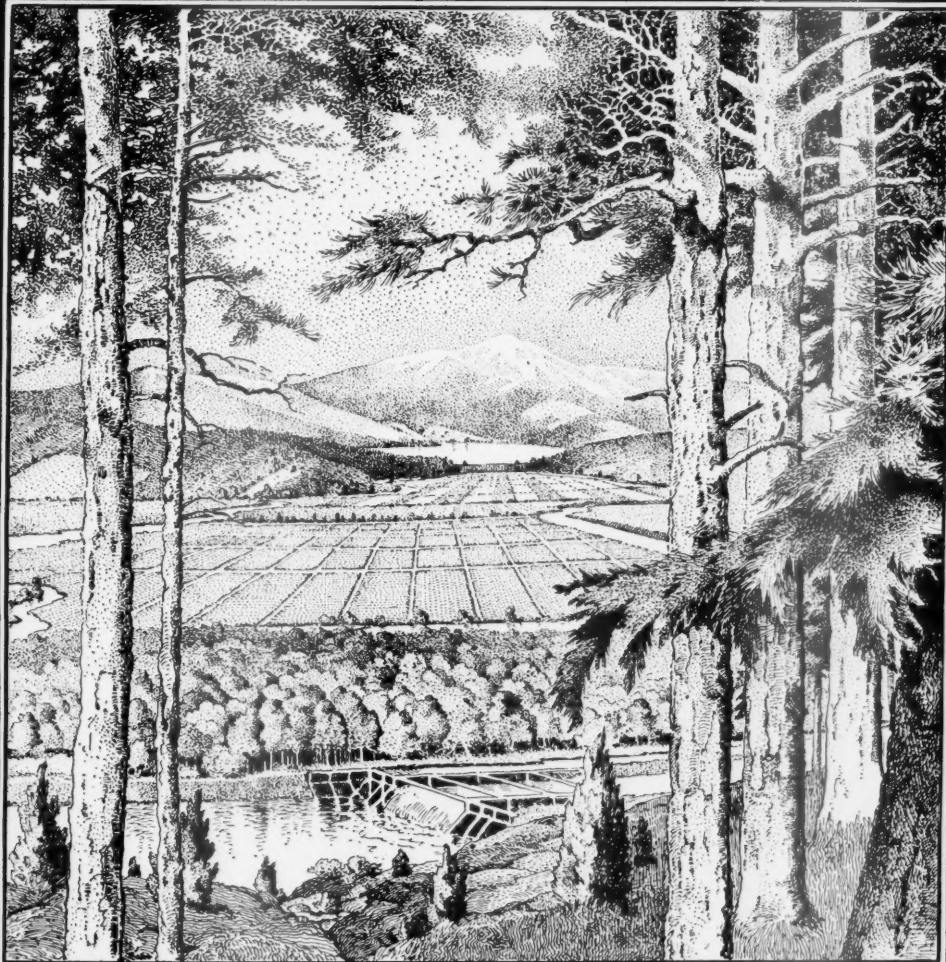


A NATIONAL IRRIGATION POLICY, by Senator H. C. Hansbrough
Vol. VIII—No. 3 MARCH, 1902 \$2.00 A Year

FORESTRY & IRRIGATION



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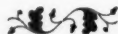
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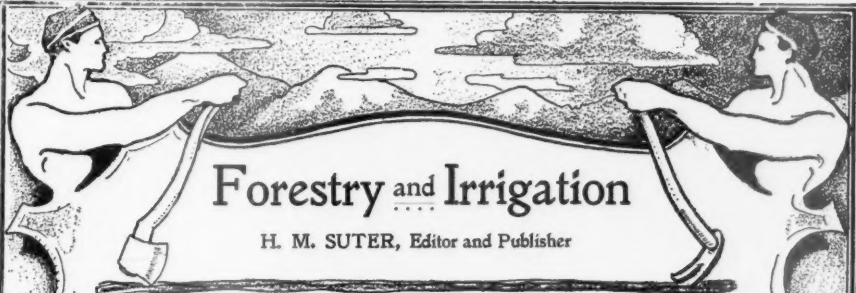
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The objects of the Association, as set forth in its Constitution, are as follows:

1. The adoption by the Federal Government of a permanent policy for the reclamation and settlement of the public domain, under which all the remaining public lands shall be held and administered as a trust for the benefit of the whole people of the United States, and no grants of the title to any of the public lands shall ever hereafter be made to any but actual settlers and homebuilders on the land.
2. The preservation and development of our national resources by the construction of storage reservoirs by the Federal Government for flood protection, and to save for use in aid of navigation and irrigation the flood waters which now run to waste and cause overflow and destruction.
3. The construction by the Federal Government of storage reservoirs and irrigation works wherever necessary to furnish water for the reclamation and settlement of the arid public lands.
4. The preservation of the forests and reforestation of denuded forest areas as sources of water supply, the conservation of existing supplies by approved methods of irrigation and distribution, and the increase of the water resources of the arid region by the investigation and development of underground supplies.
5. The adoption of a harmonious system of irrigation laws in all the arid and semi-arid states and territories under which the right to the use of water for irrigation shall vest in the user and become appurtenant to the land irrigated, and beneficial use be the basis and the measure and limit of the right.
6. The holding of an annual Irrigation Congress, and the dissemination by public meetings and through the press of information regarding irrigation, and the reclamation and settlement of the arid public domain, and the possibilities of better agriculture through irrigation and intensive farming, and the need for agricultural education and training, and the creation of rural homes as national safeguards, and the encouragement of rural settlement as a remedy for the social and political evils threatened by the congestion of population in large cities.



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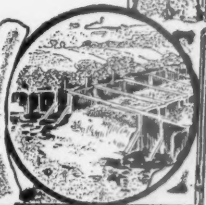
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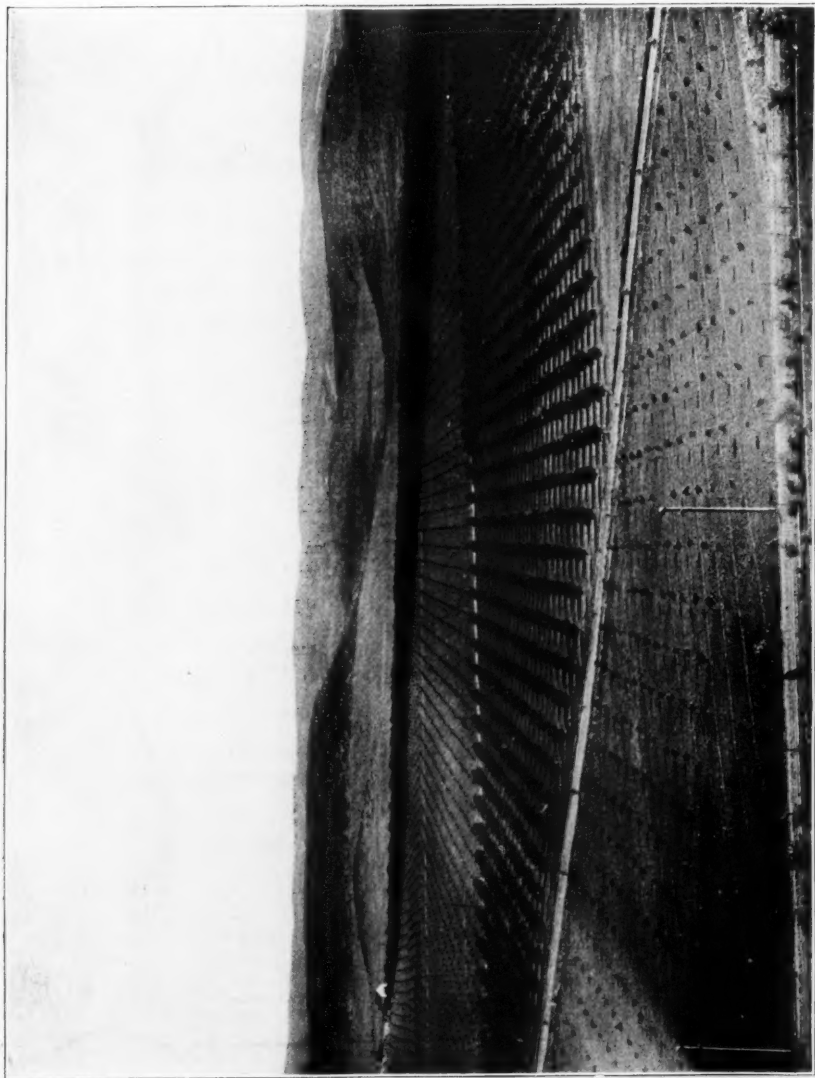
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RECLAIMED DESERT LANDS, SOUTHERN CALIFORNIA; FORMERLY COVERED WITH CACTUS. IN THE FOREGROUND A
YOUNG ORCHARD, BEHIND THIS AN OLDER ORCHARD, AND IN THE DISTANCE THE ARID HILLS.

Forestry and Irrigation.

VOL. VIII.

MARCH, 1902.

No. 3.

NEWS AND NOTES.

Irrigation Bill Passed by Senate.

The Senate passed the irrigation bill Saturday, March 1. There was not even the formality of a roll-call, the sentiment being unanimously in favor of the measure.

When the bill was taken up Mr. Stewart made a speech in its support, as did Mr. Tillman.

In the course of the debate Mr. Bacon said that he was glad attention was to be turned to the development of our internal resources, because he believed they would yield far greater returns than the will-o'-the-wisps that were being pursued in distant lands. Mr. Gallinger pointed out that the settlement of the newly irrigated lands would help the manufacturers, while Mr. Teller asserted that the measure was not local, but would benefit people all over the United States, because it would offer them sites for homes. Mr. Clay also supported the measure as a matter of justice.

The bill now goes to the House for action.

Pennsylvania Forest Reserves.

At a recent meeting of the Pennsylvania State Forestry Commission it was announced by Dr.

Rothrock that the forest property in the South Mountains, acquired by the state, would be turned over about the middle of March. It comprises 40,000 acres in the Mount Alto district, in Franklin and Fulton counties. The Barre lands, in Huntingdon County, comprising 8,000 acres, were also reported to have been purchased and now in the state's hands. Negotiations for the purchase of the

Kulp tract, in Union County, from which the timber has been cut by ex-Congressman Kulp, were announced as concluded, and the state will soon take possession of the 28,000 acres.

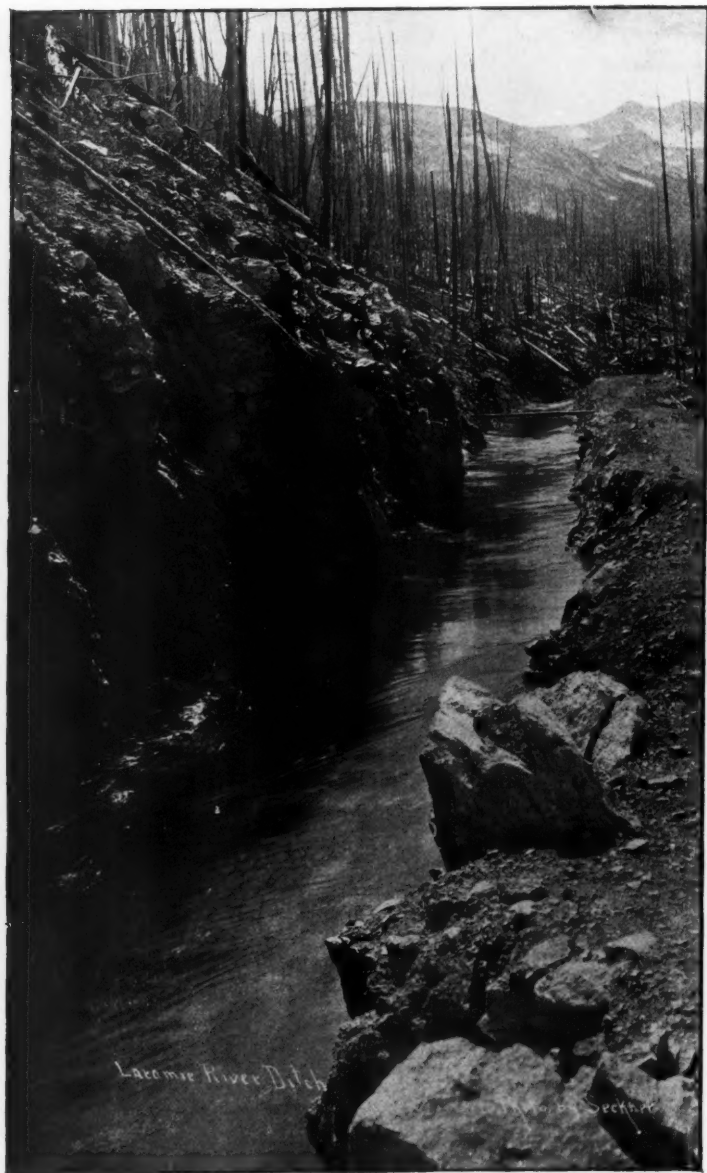
The state reserves now contain 325,700 acres of land, and the Commission expects to acquire 100,000 acres additional during the present year.

At the twenty-fifth annual meeting of the Pennsylvania State Board of Agriculture, held recently at Harrisburg, a resolution was adopted which asks the legislature to furnish funds to establish a training school in elementary forestry. The resolution is worded as follows:

Resolved, That the legislature of Pennsylvania be requested to furnish funds requisite for the establishment of a training school of elementary forestry at Graeffenburg, Adams County, where, on the state reservation, the pupils may, by work done in the state forests, earn what it costs the commonwealth to board, clothe, and educate them, provided said pupils furnish bond to repay the state what it costs to educate them if they fail on examination or are discharged for misconduct.

Forest Fires.

In spite of this being the winter season, it seems that the danger from forest fires, in certain sections of the country at least, is considerable. From Gabriella, Fla., comes the news that "forest fires are raging all through this section of country, doing considerable damage. Horne & Petteway, the turpentine firm, have lost about 12,000 boxes. The fires will cause heavy loss to the stock-owners, as the grass is all burnt off, and it is so dry



VIEW OF SKY LINE CANAL ; TAKING WATER FROM THE SOURCES OF BIG LARAMIE RIVER AND DIVERTING IT INTO THE CACHE LA POUDRE ABOVE CHAMBERS LAKE, NORTHERN COLORADO, AT THE HEIGHT OF 8,000 FEET.

that the new grass will be long in starting."

Near Sampson City, Fla., forest fires have been burning for two weeks, doing great damage to farmers and turpentine timber. Many buildings have been threatened.

The grist mill and cotton gin belonging to Col. T. N. Winn, near Hinesville, Ga., were burned a few days ago as the result of a forest fire.

In this connection attention is called to the article on "Forest Fires in Colorado in 1901," published elsewhere in this number. The author of this article, Mr. Henry Michelsen, has for years been a strong advocate of forest preservation, and each season he keeps a careful record of all forest fires which occur in Colorado.

University of California. Dr. B. E. Fernow, Director of the New York State College of Forestry, has been appointed lecturer on forestry at the next summer session at the University of California, to be held during July and August, 1902.

Dr. Fernow will spend three weeks in the instruction of those interested in the profession of forestry, and will also deliver nine illustrated evening lectures.

Measurement of Water. There are in common use two units of measurement of water when used in irrigation—that giving the rate of flow, as of a stream, and that stating the cubical quantity, as of water contained in a reservoir.

The cubic foot per second (second-foot) is the unit for the rate of flow. This is a quantity of water delivered by a rectangular flume one foot wide and one foot deep and flowing at the average rate of one foot a second. In round numbers this is equal to $7\frac{1}{2}$ gallons each second, or 450 gallons per minute.

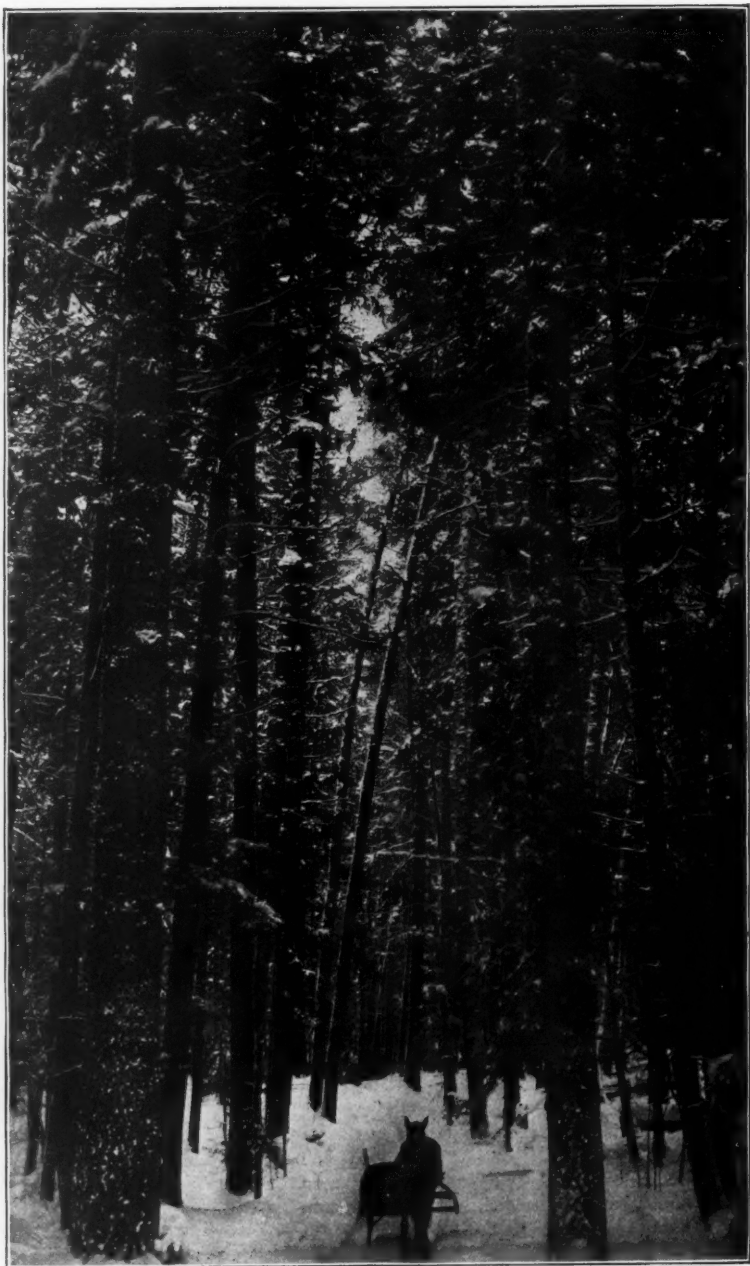
The rate of flow is sometimes expressed in miner's inches, but this is an indefinite quantity. In Arizona 40 miner's inches make a cubic foot per second, and in California 50 miner's inches make a cubic foot per second.

In various localities there are intermediate values.

The unit of capacity used in irrigation is the acre-foot, or one acre covered one foot in depth, equivalent to 43,560 cubic feet. One cubic foot per second flowing for twenty-four hours will cover an acre 1.98 feet in depth. In round numbers, a cubic foot per second for a day is equivalent to two acre-feet.

Meeting in Michigan. The Joint Meeting of the Michigan Political Science Association and the Michigan Farmers' Institutes was held under the auspices of the Michigan Agricultural College (near Lansing) on February 25, 26, 27, and 28. The programs for the various sessions included discussions and addresses on state problems of political science, forestry, agriculture, and allied subjects. The Honorable James Wilson, Secretary of Agriculture, addressed the convention on the relationship of the "Department of Agriculture to the Farmer." Mr. Gifford Pinchot, Forester of the U. S. Department of Agriculture, was to have delivered an address on "The Condition and Significance of the Forest Movement," but was unavoidably prevented from attending the meeting. Mr. George B. Sudworth, Chief of the Division of Forest Investigation, Bureau of Forestry, spoke on "The Origin and Development of Forest Work in the United States." Mr. E. A. Wilkey, Michigan State Land Commissioner, presented a paper on "The Forestry Problem in Michigan." C. A. Davis, Professor of Forestry in the University of Michigan, and the Hon. Chas. W. Garfield, President of the Michigan State Forest Commission, spoke on the needs of forest work in Michigan. The meeting was widely attended by representative Michigan men and was of unusual interest.

In conjunction with the above convention, the Michigan State Forest Commission held an important meeting, at which the work of the Commission during the past year was discussed. Mr. George B. Sudworth spoke to the Commission on "Special Forest Investiga-



A MICHIGAN WHITE PINE FOREST IN WINTER.

tions Needed in the State." Professor Lane, State Geologist, discussed the possible coöperation of his department with the forest commission. The work of the forest commission is promising. A wide public interest has been awakened by the commissioners in favor of state forest work, and it is expected that suitable appropriations and legislation will give the commission increased opportunities for further practical work.

Winter Irrigation of Orchards.

Experiments have been made in southern Arizona to ascertain whether water can be advantageously applied during the winter season, when an ample supply can be had, but withheld during the summer, when there is a deficiency. In 1888 a portion of an orchard was not watered from September until January, 1889, when winter irrigation was begun and continued until the end of March. In all eight irrigations were made, the water being applied through furrows. The ground was cultivated after the last irrigation to check evaporation. Water was again applied in June, but not again during the season. The trees grew thriftily and maintained a vigorous appearance all summer. During the following winter about 3 feet of water in depth was applied and the ground again plowed each way and harrowed thoroughly. After each summer shower the soil was again cultivated to maintain a mulch of dust 6 or 8 inches deep. No irrigation water was applied for 8 months, during which period the rainfall was only 2.5 inches. The trees remained in excellent condition, and during the hot, dry period a good crop of excellent apricots was obtained. An examination of the roots of the trees showed that they had penetrated in large numbers to a depth of from 12 to 16 feet, some going down to 20 feet. The conclusion has been reached that by applying about 3 feet of water during the winter and with frequent cultivation a deciduous orchard can be maintained in good condition throughout the year, even in the hot, dry climate of Arizona, particularly where the soil is deep and retentive of moisture.

Irrigation in New Jersey.

Irrigation was reported on 8 farms in 1899. Of the 73 acres irrigated, 69 acres were devoted to crops, as follows: Hay, 26 acres; vegetables, 20 acres; corn, 13 acres; celery, 6 acres; seeds, 4 acres. The total value of the crops produced was \$8,720, an average of \$126 per acre.

The average value per acre of irrigated land was \$155. The total capital invested in irrigation plants was \$2,831, and the average cost of irrigating was \$36 per acre.

Forestry in Maryland.

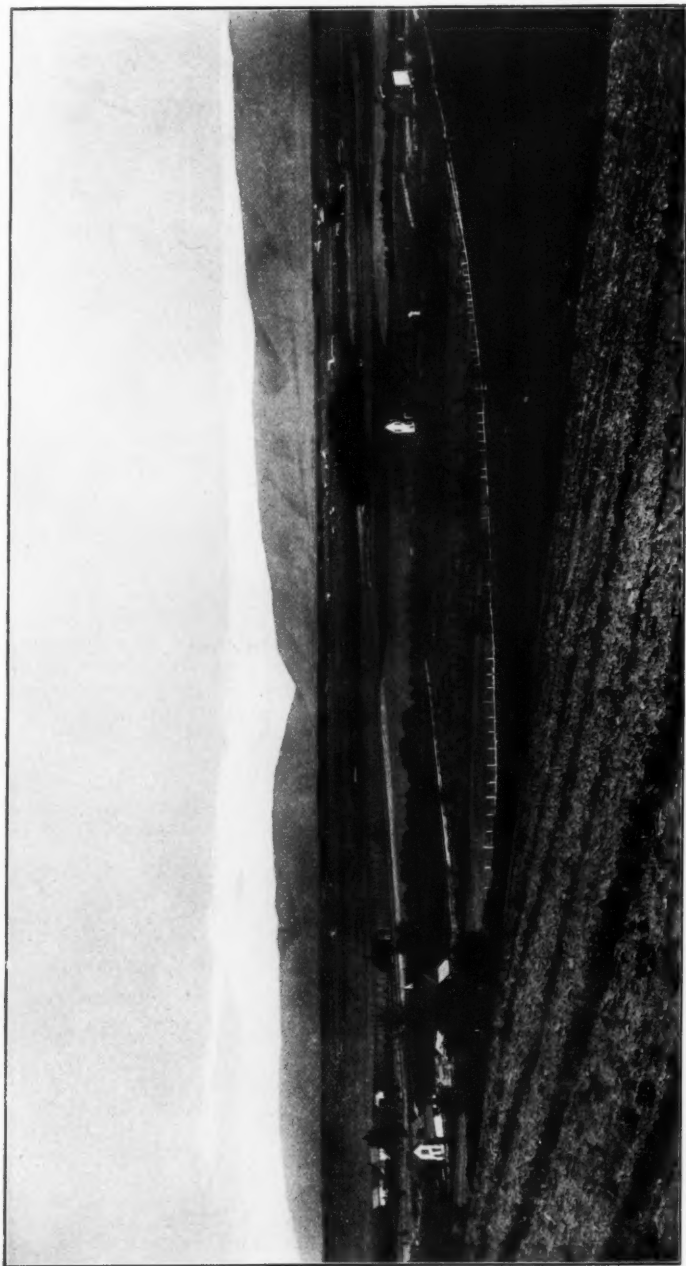
Improvement of forest conditions is a subject being considered by the present session of the Maryland legislature.

Mr. Harry, of Frederick County, has introduced in the house a bill to create a state board of forestry, to consist of three members, to be appointed biennially by the governor, by and with the advice and consent of the senate.

The commissioners are to be male citizens not under 30 years of age nor over the age of 60 years, one of whom at least shall possess a scientific knowledge of forestry and at least two of whom shall each own 100 acres of farm land within the state. One of the commissioners shall always be a resident of the Eastern Shore and one of the sixth congressional district.

The commissioners are to have their office at Annapolis and are to receive a yearly salary of \$600 each. They are to employ a secretary at a salary to be fixed. It is to be the duty of the board to acquire, in the name of the state, such woodland along the headwaters of the rivers of this state as may be offered at a price not exceeding \$8 an acre, the amount purchased in any one year not to exceed the money at the disposal of the board. Provision is also made for the purchase of deforested land in the judgment of the board.

Arrangements are made for paying a bounty of 10 cents each for Locust, Black Walnut, Black Oak, Red Oak, or Hickory trees planted by land-owners under certain regulations, and 5 cents for each



GENERAL VIEW OF ATANUM-MOXEE VALLEY, WASHINGTON.

Chestnut or other trees whose wood may be used for fencing or building purposes. A yearly appropriation of \$30,000 is provided for the purchase of lands, \$5,000 for bounties, and \$6,000 for salaries and expenses of the board.

Extent of Present Irrigation.

The irrigated area is approximately 7,500,000 acres, the greater portion of this being in the states of California and Colorado. During the last ten years the irrigated area has been extended, the increase being due mainly to a more complete use of water from ditches already built and not to new construction.

In recent years comparatively few large works have been built, but those constructed from about 1885 to 1895 have been gradually enlarged and more land brought into irrigation. Most, if not all, of the large speculative enterprises for reclamation are in the hands of receivers, the stockholders have lost everything, and the bondholders are being called upon to maintain the works. There exists the anomalous condition that, although the enterprises are bankrupt, large values have been created. For example, in the case of the Bear Valley Company, the investment of about \$1,000,000 is estimated to have created values of very nearly \$5,000,000. The enormous apparent profits have not gone to the investors, but to the public in general.

Tree Planting by Illinois Central.

The officials of the Illinois Central Railroad recently decided to begin tree planting along their lines from Chicago to New Orleans. The distance from Chicago to New Orleans is about 900 miles, and it is the company's intention to plant over 200,000 catalpa trees.

At first it was thought to set aside one or two tracts on which to plant the trees, but it has now been decided to string the forest over the entire system. They will not be set out after any pattern or design, but will be planted in the ground around stations, along the

right of way in the country, around warehouses, and every place where they may grow and at the same time add to the surroundings with their shade.

The contract for this planting has been let to a private firm. Agents of this firm are now in the field locating places where the larger numbers of trees are to be planted.

Scarcity of timber for ties is the cause of the planting of these trees by the railroad. During the last two or three years much difficulty has been experienced by railroad officers in obtaining the proper timber for ties, and the great amount used for this purpose has drawn heavily on the lumber markets of the country for the right kinds of wood.

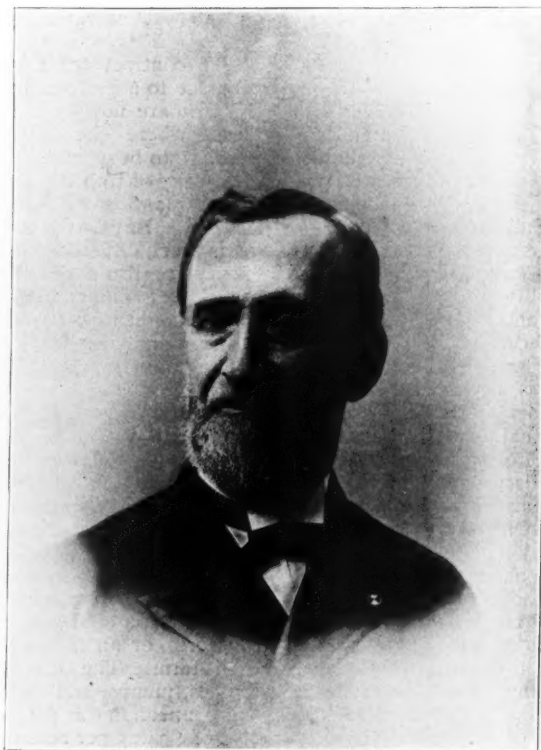
Irrigation in Connecticut.

Intensive farming by means of the artificial application of water has been successfully practiced as far north as Connecticut. The Census Office has recently published figures showing that in 1889 there were under irrigation 56 farms, with a total area under ditch of 471 acres, or an average of 8 acres on each farm. The cost of the pipes, ditches, pumps, and reservoirs used in this connection was \$16,113, an average cost of \$34.25 per acre irrigated.

To Cut Timber in the Adirondacks.

Assemblyman Davis has introduced a concurrent resolution in the New York Legislature carrying out the recommendation of Governor Odell permitting forest timber to be cut in the Adirondacks, under rules adopted by the Forest Preserve Board; also allowing the laying out of roads along such routes as may be approved by the Board; but no steam railroads shall be constructed or operated upon state lands in the forest preserve.

The legislature is also permitted by the provisions of the resolution to authorize the sale of state lands outside of the Adirondack Park, and the proceeds are to be applied to the purchase of lands within the Adirondack Park.



HON. REDFIELD PROCTOR,

UNITED STATES SENATOR FROM VERMONT, AND VICE-PRESIDENT OF
THE AMERICAN FORESTRY ASSOCIATION FOR VERMONT.

SENATOR PROCTOR, chairman of the Committee on Agriculture and Forestry, and one of the most effective friends of forest conservation in the United States Senate, was born at Proctorsville, Vermont, January 1, 1831. He graduated from Dartmouth College in 1851, and from Albany Law School in 1859, and was admitted to the bar at Albany and Woodstock, Vermont, the

same year. During the next two years he practiced law at Boston, Massachusetts. In June, 1861, he entered the Third Vermont Regiment as lieutenant and quartermaster. In July of the same year he was placed on the staff of Gen. W. F. (Baldy) Smith, and in October was commissioned major of the Fifth Vermont Volunteer Militia. With this regiment he served one year around

Washington and on the Peninsula. In October, 1862, he was made colonel of the Fifteenth Vermont, a nine months' regiment, and commanded it at the battle of Gettysburg, and until its term of service ended. After the war Colonel Proctor formed a law partnership at Rutland, Vermont, with W. G. Veazy, but in 1869 he gave up law practice and accepted the office of manager of the Sutherland Falls Marble Company. In 1880, when that company, with another, united as the Vermont Marble Company, one of the largest companies of the kind in the world, Colonel Proctor was chosen president, and in this position displayed rare executive ability. He took a keen interest in the welfare of the 1,000 workmen employed by the company, and presented them with a library of 3,000 volumes.

He began his political career as a selectman in Rutland; later became a member of the Vermont legislature—1867, 1868, 1888. He was a member of the state senate and president *pro tempore*—1874–1875.

Colonel Proctor was elected Lieutenant-Governor of Vermont in 1876, and in 1878 was chosen Governor by 20,000 majority. His administration of that office resulted in a reduction of state expenses, the passage of a law establishing savings banks, a law compelling every tax-payer in the state to swear to his list, and a revision of the statutes of the state. He was a delegate to the National Republican Convention of 1884, and in 1888 was chairman of the Vermont delegation to the Chicago National Republican Convention.

In March, 1889, he was chosen Secretary of War by President Harrison, and filled that position until November 2, 1891, when he was appointed U. S. Senator by Governor Page, of Vermont, to succeed Hon. Geo. F. Edmunds, who had resigned. He took his seat December 7, at the opening of the Fifty-second Congress.

While Secretary of War, he gave special attention to coast and border defense, the building of modern guns for fortification and field purposes, the re-

organization of the army, and the preparation of new tactics to meet modern conditions. He gave unremitting attention to the subjects of bettering the condition of enlisted men and raising the standard of recruits. The rations were improved, the rewards for soldierly conduct raised, and the difficult subject of punishment received close attention.

Under the lead of Secretary Proctor more wholesome legislation was secured for the army than at any previous time in an equal period. The country has reason for deep satisfaction in the progress made during his administration in the work of national defense. He gave his attention to this vital subject from the moment he entered upon his duties. His personal experience at the time of the St. Albans raid gave the question of border defense along the Great Lakes its proper weight in his mind in relation to the great and pressing problems of harbor protection. His work was quiet, but effective. He soon created unusual interest in the committees of the House and Senate in charge of this matter. His plain and practical presentation of the fact that our great cities, both on the sea and lakes, were utterly defenseless soon carried conviction and gained general support for an appropriation as large as could be profitably expended within the year for the purchase of sites for fortifications for the construction of batteries and mines, for establishing the great gun factory at Watervliet, N. Y., and for the manufacture of heavy guns for sea-coast defense.

In 1892 Senator Proctor was elected to fill both the unexpired term of Senator Edmunds and also the succeeding term. He was re-elected in 1898, and his present term will expire in 1905. Early in 1898 he visited Cuba, and his speech in the Senate on the Cuban reconcentrados after his return attracted wide attention. Senator Proctor, in addition to being chairman of the Senate Committee on Agriculture and Forestry, is also a member of the Committees on Military Affairs, Fisheries, the Philippines, and Industrial Expositions. His home is at Proctor, Vt.

A NATIONAL IRRIGATION POLICY.*

BY SENATOR H. C. HANSBROUGH.

THE purpose of this policy is to assist in providing homes for the rapidly increasing population of the country. President Roosevelt stated the case in a few words when he said in his message that "successful home-making is but another name for the upbuilding of the nation."

To say that the national government cannot, within the Constitution, do its part in the development of the latent wealth that exists in a region that is nearly one-third of the total area of the United States is to discredit the genius of the American people. To say that we may not utilize the waste waters that pour down from the mountain heights, and by applying these waters to public lands that would otherwise be worthless make two blades of grass grow where none grew before, is to admit that national progress has reached the end, and that we are henceforth doomed to slow decay.

If I may be pardoned for referring to the constitutional features of the case, I find that it has been deemed expedient under the Constitution to construct large reservoirs at the headwaters and along the tributaries of our great rivers for the benefit of navigation, and incidentally, not accidentally, these reservoirs have been and are now being used as storage places for millions of saw-logs. In some instances navigation has come to be the incidental and log storage the chief purpose. Appropriations for this work have been made, amounting to many millions of dollars, directly from the Federal Treasury. By the terms of this bill it is proposed to devote the receipts from the sales of public lands to the improvement of the lands, converting the desert into productive fields and pastures and making homes for homeless people. It is proposed to conserve the torrential waters of the streams and put them upon the plains for the primary benefit of the

husbandman, the incidental protection of navigation, and the ultimate and permanent benefit of the nation. Touching this phase of the question, the President very aptly says that "the storing of the floods in reservoirs at the headwaters of our rivers is but an enlargement of our present policy of river control, under which levees are built on the lower reaches of the same streams."

It will be a difficult task to find a constitutional distinction between these two classes of work. Had the reclamation of the public domain been a burning question when the Constitution was framed, perhaps the gentlemen who are now interested in the deepening and widening of channels and the storage of saw-logs for the benefit of navigation would be without as well as within these doors clamoring for recognition under the general-welfare clause of our organic law. No one has thought of complaining of the policy of opening rivers to navigation at government expense, so that settlers might go in and lay out new fields of enterprise and industry, and there has been no objection to keeping these rivers open at government expense, so that the people could market their products. It would be a bold mathematician who would undertake to compute the amount of public money spent in this way. It is conceded that great national benefit has resulted, so we do not stop to ask the cost.

The advocates of a national irrigation policy submit a plan whereby large areas of land now practically worthless may be opened, not at government expense, but at a cost to be assessed against the land. Out of these activities will come a new demand for manufactured products. This will make New England a party in interest. Pennsylvania and Ohio will secure a share of the new orders for steel. The South will find an additional market for her cotton and tobacco.

* Extract from a speech delivered in the United States Senate February 6, 1902.

The urgency of the case lies in the fact that the public domain in the humid and sub-humid sections of the West is well-nigh exhausted. The frontiers of western settlement are on the very verge of the arid and semi-arid region. Indeed, a large proportion of the home seekers of the past two years, in their eagerness for lands, have pushed on beyond the humid into the semi-arid areas.

It should be understood at the outset that the plan proposed by this bill does not require a great outlay of money; that it does not contemplate a "raid upon the Treasury." Neither is there the slightest probability of an overproduction of small grains as a result of the successful operation of the project.

The cost is limited to the proceeds from the sale and disposal of public lands in the thirteen states and three territories named in the bill. This would involve a sum aggregating, perhaps, \$2,500,000 per annum, according to official reports on the present income from this source. It is provided in the bill that the cost of construction of each irrigation project shall be paid by the persons directly benefited. Thus the money expended would constantly be recouped or repaid to the reclamation fund, making the system automatic and self-sustaining.

As to the fear of overproduction of farm products, there is no ground whatever for alarm. While it is true that there are in the great West about 600,000,000 acres of lands which might be irrigated, the essential fact is that there is not sufficient water available, and never will be, to reclaim more than 10 per cent. of the whole area, or about 60,000,000 acres. It should not be taken for granted, however, that the whole of this area would be irrigated from government works. The irrigation experts of the Geological Survey, basing their calculations upon the most thorough investigations in the field, give it as their opinion that 20,000,000 acres would be the limit of land irrigated from waters conserved by government enterprises, but that this would serve as a nucleus about which private effort would reclaim an equal amount, or 40,000,000 acres in all.

With the disposal and settlement of more than 13,000,000 acres of the public domain in 1900, the average December prices for all farm products in 1901 were much above the average prices for any year as far back as 1892; so that the rapid settlement of the public domain cannot truthfully be said to have affected detrimentally the prices of farm products; nor can it be maintained that the opening of a little more than half a million acres annually by means of irrigation would result in overproduction. On the contrary, it is the history of all irrigated sections that the output of bread foods from irrigated lands rarely meets the local requirements.

Wherever irrigation has been successfully applied large communities have grown up. New mines have been opened in the adjacent mountains, manufacturing have been established in the valleys, and railroads have been extended. Naturally these enterprises bring in large numbers of people. All students of irrigation will attest the declaration of the fact that grasses, fruit, and vegetables are the chief products that come from irrigated lands. In recent years there has been a great scarcity of forage for stock. The large ranges are being gradually denuded of their grasses, and in many instances stockmen have been obliged to decrease their herds. The natural consequence is a falling off in the number of beef cattle in the West as compared with the increase in population, and an inevitable increase in the price of meats in all the markets of the country. The inauguration of a broader and more general system of irrigation would be a great boon to the stockmen, as well as to the consumers of beef. With hay selling at from \$8 to \$13 per ton, the irrigator would devote himself to the production of grasses, thus solving the problem which so closely concerns the owners of herds.

The necessity of immediately adopting some definite policy with respect to irrigation arises from the fact that under existing land laws sources of water supply are being seized upon with great rapidity, largely by men who are not able to utilize them and who are holding them for speculative purposes. For

example, a man may secure control of a spring or locality where water might be held to irrigate 10,000 acres. He holds this for his cattle or for raising forage. He has not the means to conserve the water, nor could he do this profitably. It is of no particular interest to him whether 50 or 100 families or more might make homes upon the vacant land adjoining. If he could build the works, if he could get the people there, and if having them there he could exercise governmental control over them, he could make a fortune; but he cannot do it, and so these public lands around him lie idle.

There are thousands of such instances. In one way or another control of the situation is rapidly passing away from the people, and vested rights are growing up. This absence of wise control, if continued, must result in the arid West remaining thinly populated, instead of furnishing opportunities for millions of people. Nothing less than prompt action on the part of Congress can prevent this calamity.

The construction of works of reclamation by the government does not necessarily involve the actual irrigation of the land by the government. By saving the floods or by constructing large diversion works, taking water from a river and turning it over a divide, it becomes possible for the settlers to build their own distributing systems in the same way that the pioneers have done.

The people who originally came to the arid West found a scanty but widely distributed water supply, which they proceeded to utilize. This they have done up to the limit of the available sources. There are other vast quantities of water, however, which are beyond the reach of settlers, and cannot be used until regulated or conserved. It is impossible for a home-seeker to go out upon the desert and, unaided or by co-operation, build great reservoirs such as are constructed in other countries by the government.

For several years past our trade with foreign countries has been phenomenal. This is especially true as respects our exports. First we tempted the foreign appetite with our bread foods, and soon the whole world began to buy. Then

we sent across the seas the samples of our mechanical skill. Orders have been pouring in for our manufactured goods, until now our modern railway equipments, our electrical appliances, our steel bridges, our farm machinery, and a hundred other mechanical appliances, the product of American mills and factories, are to be found in successful use around the globe.

The demand has been so stupendously great that we are justified in pausing to ask if it is to continue indefinitely. The answer is that ultimately there must be a limit to the ability of foreign countries to buy; that in the very nature of things the demand cannot outrun the supply. Indeed, there are evidences that the manufacturer must soon turn again to the good old home market if he would keep his enlarged factories in operation. When he does, he may not find the home market ready to take all his surplus products. Reveling in the saturnalia of trade with foreign countries covering the past half dozen years, he may have overlooked the prime duty of urging an important line of development, namely, the expansion of domestic resources. He will find the arid region of his own country unclaimed. He will find the mountain torrents going to waste, Congress having failed to authorize their utilization in the interest of home-building. He will find a multitude of men crowding the great cities who should be adding wealth to the nation and bettering their own condition by tilling the soil.

This presents but one of several neglected opportunities. The best industry is home industry. The best market is the home market. The most substantial and enduring wealth is that wealth which is permanently attached to the nation as a result of domestic enterprise. The foreign market is in many ways a transitory thing. We control it to-day; to-morrow it may be lost to us. We put our highest hopes in it with the ever-present danger of having them shattered. A policy of self-reliance is the best policy with nations as with men. It is the pursuit of this policy that has brought us greatness as a nation and as a people.

THE MAY FLOOD (1901) IN THE SOUTHERN APPALACHIAN REGION.

I.

IN THE CATAWBA RIVER VALLEY, NORTH CAROLINA.

BY WADE H. HARRIS,
Of the Charlotte (N. C.) Observer.

THE disastrous freshets in the valley of the Catawba River during the past year have set the people to thinking, and they will hail with delight any practical scheme that may be advocated to lessen the danger from these floods in the future. The matter has been very thoroughly discussed since the heaviest flood of the series occurred, last May, and the conclusion has been reached that the destructiveness of the flood is to be attributed not so much to the amount of rainfall as to the destruction of the forests along the headwaters of the Catawba and its tributaries. The contention is made by people who have lived along the Catawba River all their lives, that while the recent rainfall has not been unprecedented, the destruction

wrought by the freshets last year is without a parallel.

The characteristics of the Catawba River floods have undergone a sudden and alarming change. In previous years all floods along this river rose slowly. The water stagnated like a mill-pond over the bottom lands and, gently receding, left a deep, rich deposit on the already fertile bottoms. The floods have changed, therefore, from an agency of good to the farmers to one of absolute destruction—a quick, tumultuous rise of waters and a swiftly rushing current that tears up the soil down to the rocks and hard clay and leaves barren wastes. This extraordinary and deplorable change in the characteristics of the floods has followed the laying



A FLOODED FARM. ORCHARDS AND FIELDS UNDER WATER, WITH RESIDENCE AND OUTBUILDINGS THREATENED.

waste in recent years of thousands of acres of woodlands in the western part of this state.

The illustrations accompanying this article were taken along the Catawba River during and after the flood of May 21, 1901, and a study of them will give a better idea of the destruction wrought than could be obtained from any written description.

The rainfall which produced this flood began falling along the Catawba and its headwaters on May 18 and ended on May 21. The rise of the river was very rapid, and the current was at different points 10, 12, and 15 miles an hour, making an average of over 12 miles. This was in the lower section of the state, where a

in two of the illustrations. One is that of a corn field destroyed by a deposit of sand. Here and there the photographer could see the corn tassels protruding from the sand. The railroad embankment to the left prevented this bottom from being washed out and caused the deposit.

At other points along the river steep hillsides brought about the same results. The other illustration in question shows where the soil was washed away to a depth of eight feet. The tips of the "cow root," as it is known by the farmers, held up by the man, are yet in the hard clay down to which it had grown. The leaves at the top show the former level of the bottom land. These

pictures represent the conditions prevailing to a greater or less extent along both banks of the Catawba in McDowell, Burke, Caldwell, Alexander, Catawba, Iredell, Lincoln, Gaston, and Mecklenburg counties.

The most serious aspect of the situation is that in most cases the damage to farm lands, if not permanent, will outlast the present generation. The cutting down of the banks have lowered them so that in the future the lands will be more at the mercy of floods than ever. The crops will be damaged as much



VIEW OF A CORN FIELD BURIED UNDER A BED OF SAND TWO TO SIX FEET IN DEPTH.

current of that swiftness was unprecedented. Along the upper Catawba the current was, of course, much swifter. So rapid was the rise that farmers had no chance to take measures for safety, and great numbers of cows and hogs were lost.

In many places residences which had never before been approached by the river were partly submerged, but it was not until the flood had subsided that the farmers obtained an idea of the extent of the devastation it had wrought to their lands. Some bottoms were buried under a deposit of sand varying from two to eight feet in depth, while others were washed out to the bare clay. These two peculiarities of the flood are shown

by the small freshets now as they were by the larger and less frequent floods of the past.

Mr. E. W. Myers, of Chapel Hill, who is connected with the United States Geological Survey, made a tour of the Catawba River valley a week after the flood, and estimated the apparent damage to farming lands at \$500,000; but this estimate is probably below the mark. In his official report he says: "The whole secret of the bad effect and extent of the flood lies in the deforestation in the western part of the state. Along the Linville River and in all parts of western North Carolina the country is being stripped of trees, and this is followed by forest fires, which sweep away

all undergrowth. When the rains fall on such land there is nothing to retard the current of the water. With great force it strikes the river. The velocity of the Catawba is increased by the mad violence of the water, and the current develops a wonderful and dangerous power. Every man who lives by the river says without hesitation that the cutting away of the timber is entirely responsible for the serious floods."

There have been two notable floods in the Catawba River in the past. The first was in 1848, and the second was in 1876. In neither instance was there any damage to farm lands. The water rose slowly and receded gently, leaving the river bottoms richer by a deposit of fertile sediment. There is no government record of the rainfall during those periods, but Catawba River land-owners say that there was as much water in the bottoms during the freshet of 1876 as there was last May.

The official reports of the Weather Bureau are interesting as bearing out the theory that the destructiveness of the floods of recent years is due to forest denudation. The heaviest rainfall of last May was 8.86 inches, at Marion, on the 19th and 21st. At Morganton it was 4.50 inches and at Charlotte 3.60 inches. On September 22 and 23, 1898, the rainfall at Marion was 7.11 inches, at Morganton 4.77, and at Lenoir 6 inches. On October 21 and 22, 1900, the rainfall at Marion was 7.97 inches, and at Linville 9.50 in one day (October 21). The rainfall at Morganton was 5 inches on October 11, 1897; 8.67 inches on July 3-8, 1896; 5 inches on October 13, 1893; 6.60 inches on September 9-13, 1893, and 5.80 inches on September 22, 1892. Morganton is about central of the Catawba head-



EIGHT FEET OF SOIL GONE. A "COW ROOT" IN THE HARD CLAY. THE TOP WAS FORMERLY AT THE SURFACE OF THE LAND.

waters, and the rainfall there is about an average of the mountain sections.

Bearing out the theory of forest protection for the prevention of floods is the experience of Dr. P. L. Murphy, superintendent of the state hospital at Morganton, and it is a practical illustration of how the proper care of forest growth affects the flow of water in a stream. The state hospital obtains its water supply from a stream in the South Mountains, known as Black Fox Creek, and owns 400 acres of land, including its head springs and watershed. For twenty years past no timber has been cut on this reservation, there have been no forest fires, and the ground is thickly covered with leaves, mold, and undergrowth. Near by is another stream of the same size, but the hills that shelter its head springs have been denuded of timber, and the leaves have been frequently burned. Dr. Murphy had the volume of water in each stream accurately measured last year, in May and again in August. Between those periods the Black Fox Creek had lost only



WRECK OF BRIDGE ON THE SOUTHERN RAILWAY OVER
THE CATAWBA RIVER; PART STANDING WAS
SAVED BY RUNNING LOADED
CARS UPON IT.

10 per cent. of its volume of water, while the loss in the other stream was 38 per cent.

The three agencies at work in the destruction of the forests are the woodman's axe, the tanbark stripper, and the forest fire. The chips and debris and the dead trees left by the two first named feed the latter and facilitate its work of destruction. The destruction of the forests in North Carolina is really a work of recent years, and has been carried on to an alarming extent within the past twelve months. It has become a very serious matter, and the need for some measures to put a stop to it is urgent. The only remedy is government protection, and the people of the state look to it for the salvation of their forests. It is certain that if the denudation of the forests of the Appalachian Range is not stopped, there will be a recurrence of these floods in a more aggravated form.

The establishment by the national government of forest reservations appears to be the



THE DAY AFTER THE FLOOD. VIEW OF FLOODED FARM LANDS.

only solution. The state laws for the protection of the forests are inadequate, and were they of a character more nearly suited to the case, it is doubtful if the state would be able to secure their proper enforcement. The constantly increasing danger from floods and the ravages to crops and farm lands is a serious thing in itself, but coupled with this is the rapid sacrifice of the noblest forest lands east of the Rockies.

The interest manifested by the people of this state in the establishment of a national forest reserve in western North Carolina is manifested in a special act passed last year by the legislature, which gives to the United States the power to acquire by purchase and condemnation lands in the high mountain regions of western North Carolina, and authorizing Congress to legislate concerning the control of said acquisition.

II.

THE MAY FLOOD IN EASTERN TENNESSEE.

By H. B. AYRES,

U. S. Geological Survey.

THE mountain torrents of eastern Tennessee, like other torrents, are habitually surprising to non-resident people; even the mountaineers, who have lived among them since childhood, sometimes lose buildings or fences, or have fields gullied by the overflow of the streams; roads are blocked by every freshet, but farmers and the town people of the river valleys suffer most notably.

The mountaineer is near the source of the stream and can see the storm

and its intensity and provide somewhat against it; but the valley people seldom have much warning of a coming flood. The most thorough destruction, too, occurs along alluvial bottoms, at those points where the torrents capriciously change their courses or leave their loads of boulders, sand, or clay during one flood, to be carried further during another. The most dangerous places are near the points where the beds of the streams lessen their grade and the tor-



WRECK OF A MILL, HAMPTON, TENNESSEE.

rents change to quieter streams. Here boulders are left during one freshet in bars, guiding the current, until a greater freshet moves them or forms a new channel around them. Here eddies collect silt and form fertile farm land that may either be swept away the next year or remain during many years of profitable cultivation. In addition to the movement and lodgment of earth and stone, driftwood has caused even more dam-

banks and from wooded islands, orchards, and flats. A large portion of other debris consisted of fence rails, slabs, edgings, and lumber from saw-mills; wreckage from barns, outhouses, houses, stores, mills, and bridges, among which there was much furniture and machinery.

The amount of damage is very difficult to estimate, owing to its variety and the far-reaching effect of the changes made.

Besides the usual items of loss, such as human lives, domestic animals, buildings, mills, logs and lumber, bridges, railroads, wagon roads, and growing crops, agricultural and other lands were washed away or gullied, deprived of humus, or covered with sand or other debris. The streets of towns and villages were covered with slime, and wells have been filled with polluted water. The flood was followed by epidemics of fever and dysentery. Stagnation of business and the discouragement of enterprise was caused through lack of transportation.

Several of the counties of eastern Tennessee suffered a direct loss of over \$1,000,000 each. Four railroads in Carter and Washington counties lost \$300,000 by damage to tracks, bridges, and buildings.

Why so much damage?

There has been much carelessness in placing buildings, bridges, roads, and railroads in exposed situations, and few people have considered the increased liability to floods through the effect of fire, grazing, and clearing

upon the forests that once covered the mountain sides.

Rain must fall before it can run off, but the rapidity of the run-off may be greatly modified. How much was the run-off modified in this case? Before the flood the streams were full and the ground was thoroughly saturated; they could hold no more water; then the heavy rain came, during which 8.8 inches of water fell in 12 hours. The amount of water to be disposed of was unusually great. In this region there



WRECK OF A RAILROAD BRIDGE, DOE RIVER, TENN.

age, especially to bridges, most of which would have staid had not floating forest debris, logs, buildings, and other bridges lodged against them and pushed them over or formed dams to spread the flood.

The debris from the forest is composed largely of branch wood, logs, and uprooted trees left along banks and bars by former freshets; but in this flood were also many culled logs, fresh from stump land, valuable logs from broken booms, and a very large number of freshly uprooted trees, torn from river

are no lakes and no dams of importance. There is very little to affect the run-off of water except the forest and other vegetation. In all his work, since the region was first settled, man has done nothing worth mentioning that has had a tendency to retard the run-off of water, but his logging, clearing, road-making, ditching, cultivation, and pasturing of land all have tended to increase it; greatly increased floods have resulted, and under present conditions may be expected in the future.

The river waters in the flood of last May were five to ten feet higher than ever known before, and when a similar abundance of rain and ground water combine again a greater flood may be expected. This will be the result unless we change our customs somewhat and keep the surface of the earth better covered, avoid making roads in stream beds, leave brush and trees growing along streams, and have ravines and gullies obstructed by forest growth. Dams also should be avoided, as, by bursting, they increase floods.

The value of the retarding effect of forest debris is a factor very difficult to determine. Mountaineers, who are close observers of such matters, say the forest, especially where the ground is well

covered by brush, leaves, and humus, and where roots make the soil porous, greatly retards the water and causes more of it to soak into the earth, while the cleared land, especially old pastures where the earth is compacted clay, sheds water rapidly. These thoughtful men undoubtedly have the right view. Evidence on this point is abundant and can be seen by any one walking over the ground. It is perhaps needless to discuss it. It is surprising, after looking over the field, that these floods are unexpected to anybody. There is abundant evidence in the alluvial deposits along the water-courses of the former volume and power of the torrents before the mountains were wooded. And why should there be surprise as we cause a return to that condition by clearing away the forest? These effects are to be expected by every reasoning person familiar with the circumstances. They are known to the observing people of the region. Why should the national government hesitate in a policy to ease or prevent the increase of these torrents while the adaptability of these mountains to forest growing, rather than agriculture, supports the reasonable demand of the people for whatever protection can be secured against floods?

COLORADO FOREST FIRES IN 1901.

BY HENRY MICHELSEN.

THE autumn seasons in Colorado are becoming longer, dryer, and hotter as the denudation of the mountains proceeds. The precipitation certainly is diminishing. The tables given below are compiled from the reports of the United States Department of Agriculture.

The vegetation was so dry that fires were started from locomotives as late as the beginning of December, resulting in two considerable conflagrations at the foot of Mount Evans, north of the South Platte Forest Reserve.

FIRES IN FOREST RESERVES.

The total number of fires in the reserves was 140, causing damage to timber

estimated at \$5,375. This shows exceedingly good work on the part of the forest authorities. To guard 3,000,000 acres, situated in a most broken country, with a loss of less than a thousand acres of live timber, is a feat denoting an admirable organization.

The only fire which might have had dangerous consequences originated at Rosemont sawmill, in section 13, township 15 south, range 68 west. It commenced on the night of September 21 and burned until September 29. The mill was situated at the bases of Big Chief Mountain and Mount Rosa. When discovered the conflagration had gained so much headway that the set-

1901.	Mean monthly temperature.	Remarks.	Precipitation.	Remarks.
	<i>Degrees.</i>		<i>Inches.</i>	
June	63.2	Normal	1.45	0.10 above normal.
July	71.6	3.8 above normal.	1.10	1.10 below normal, same as July, 1900, the driest July in 13 years.
August	68.2	1.4 above normal.	2.27	0.75 above normal.
September ..	58.8	Slightly below normal.	0.65	0.30 below normal.
October	49.6	2.6 above normal, highest in records covering 14 years.	0.60	0.60 below normal.
November ..	40.0	4.8 above normal. At Denver the mean temperature was 45.6, the highest in 30 years.	0.22	0.66 below normal, smallest precipitation for November in 30 years.
Average temperature for six months, 2.1° above normal.		Total amount of precipitation for six months, 6.29 inches.	Deficiency in rainfall, 1.81 inches, or 22.6 per cent.	

tlers of the whole region began to move their household goods and live stock to places of safety.

A huge sawdust pile, with the slabs from a million feet of lumber, was burning fiercely, throwing out streams of fire for a hundred yards. The wind was blowing a gale from the southwest, which drove the flames across the track of the Colorado Springs and Cripple Creek Railway into the tops and tops of the trees, which covered the ground thickly over forty or more acres, from which this lumber had been cut. The fire was traveling northward along East Beaver Creek up a ravine toward the summit of Mount Rosa. This mountain is heavily timbered, and there are large groves of pine and spruce upon the sides of Big Chief Mountain which must have perished had the fire been allowed to proceed in its course.

James Parfet, a ranger, called for help upon the section men employed by the railroad, who were trying to save the bridge spanning East Beaver Creek, and with their aid cleared the ridge along the south and east lines of the fire. He sent another force to the base of the mountain to confine it within the limits of the gulch, which was in flames throughout its whole length. In this they were measurably successful, but on Monday, September 23, the conflagration had nearly reached the summit

of the mountain in the vicinity of the saddle, which is here about 1,000 feet wide. By cutting a swath and by beating back the ground fires with shovels, the fire was mastered at this point, though traveling northward, however, until extinguished at its outward limits, on Tuesday, September 23. Then the wind again rose, growing gradually stronger. During this day and the following night trees were falling in every direction, but by the hardest kind of work the rangers succeeded in holding the ground they had gained to the east, south, and west, putting out hundreds of small blazes and preventing the spread of flames into the main body of timber. Some of the rangers had been at work in this manner for sixty consecutive hours. The danger was, however, not passed. Only on Sunday night, September 29, did Superintendent May, who had been on the ground all the week, consider the work of salvage complete.

To appreciate the task performed it is necessary to be familiar with the conditions of western woodlands. By incessant labor in blinding smoke, in stifling air, in undergrowth so thickly matted that it impeded every motion, amidst winds so changeable that often the hot blast would fall upon them so suddenly as to make escape difficult, these men strove to save the fine forest cover of the sources of North and South Cheyenne

FOREST FIRES IN UNITED STATES RESERVES IN COLORADO DURING THE YEAR 1901.

	Camp or small fires left burning, extinguished by forest officers.	Fires which had gained considerable headway, extinguished.	Area burnt over.	Large and important fires, requiring extraordinary efforts to extinguish.	Area burnt over.	Total area burnt over.	Live timber burnt.	Live timber partly burnt.	Undergrowth burnt.	Dry brush and dead timber burnt.	Estimated value of timber destroyed.	Causes of fires.						Total number of fires.	Acreage of reserves.
												Camper and hunters.	Prospectors.	Sheep-herders.	Lightning.	Locomotive sparks.	Unknown.		
Pike's Peak.....	26	.....	Acres.	1	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	\$1,300	26	.....	.....	.....	.....	.....	1	178,500
South Platte.....	25	.....	3	1	160	160	20	20	60	60	60	17	.....	1	.....	6	.....	29	695,000
Plum Creek.....	9	1	280	.....	100	380	60	60	.....	120	1,000	4	.....	1	5	.....	2	10	178,400
Battlement Mesa...	47	.....	30	.....	200	30	15	5	5	5	75	47	.....	.....	2	2	.....	47	864,000
White River.....	17	.....	.....	.....	.....	1,120	160	400	50	510	3,000	19	.....	.....	.....	1	.....	20	1,117,200
Newlan Creek.....	7	3	1,120	.....	.....	.....	.....	.....	.....	.....	.....	6	.....	.....	.....	.....	.....	7	14,144
Total.....	131	7	1,430	2	260	1,690	435	485	75	695	\$5,375	119	.....	1	7	10	2	140	3,047,244

and East, Middle, and West Beaver creeks. These streams provide the water for the cities of Colorado Springs, Pueblo, and the Cripple Creek district. It is difficult to give the due meed of praise to men achieving such results. The fire was undoubtedly of incendiary origin.

A fire occurred in the South Platte Forest Reserve. outskirts of a lumber camp belonging to the Rocky Mountain Paper Company on June 25, destroying timber on an area of 190 acres, situated at the head of Tallow Creek, one of the main feeders of the north fork of the South Platte River. The fire originated on state lands, but also destroyed about 100 acres of government timber. It was extinguished by U. S. Ranger Hooper, aided by seventeen resident volunteers.

During the month of July three other fires were extinguished in this reserve by Supervisor Steinmetz, aided by thirteen local volunteers. The total area burned over was 280 acres, mostly grass land, the damage to timber being estimated at only \$200.

In July there occurred four Plum Creek fires at the headwaters of Reserve. Douglas Creek, three of which were extinguished without much damage, while one burned over an area of about twenty acres, destroying timber to the estimated value of \$75. Fortunately the effect upon forest cover and water supply will be but slight.

On July 23 a fire occurred at the headwaters of the north fork of White River, destroying twenty acres of live timber and dry brush and 280 acres of dead timber. This fire was probably caused by lightning. It originated in a most inaccessible region in a windfall, and burnt itself out, causing no damage to the water supply of the surrounding region.

Another large fire occurred on September 26. It began outside of the reserve, in township 2 south, range 85 west, on Derby Creek. There was a high wind and the country was quite dry; the fire spread with great rapidity over open grass lands, through thickets

of Scrub Oak and the undergrowth of quaking aspen groves into the reserve. On October 16 the rangers finally mastered it, the precipitous and rugged formation of the ground greatly impeding their efforts. It destroyed 120 acres of live timber, principally spruce and pine; Quaking Aspen partially burned, 400 acres; undergrowth, 50 acres; dry brush and dead timber, 60 acres, and grass, 170 acres. The damage to watersheds was comparatively small, as the headwaters of the creek were not affected.

Battlement Mesa Reserve.

The practical immunity of this reserve is to be ascribed to the efforts of three volunteer fire associations, which were formed for the purpose of assisting the government officers in the prevention of fires. The work of these associations has proven so valuable that it is hoped the people living within the other reserves will also organize. It is certain that the protection afforded by the government is valued very highly by the resident citizens.

FIRES OUTSIDE OF THE RESERVES.

Summit County.

Sparks from a locomotive ignited the west slope of Mount Baldy June 29. The blaze was extinguished on July 2, the railway people and the miners having succeeded in limiting the burning area by means of trenching and back-firing. About *ten square miles* of timber were destroyed.

Jefferson County.

On July 24 a large fire started between Morrison and Pine Grove, caused by negligent campers. It was extinguished about July 28 by employes of the State Land Board, the area burnt over amounting to about *sixteen square miles*. During the month of July five separate forest fires were burning at the same time. Only in one instance were the state officers able to locate the origin in sparks from a saw-mill operated on patented land.

Park County.

A great fire was observed on Mount Evans July 24. It had evidently originated from an abandoned camp, the dry

weather permitting a rapid spreading of the flames. The mountain at night had the appearance of a volcano in action, and people came from great distances to watch the striking spectacle. About *ten square miles* of woodland were denuded.

The latest fire of the season began at the foot of Mount Rosalie October 28, burning over *seven square miles* of fine forest growth, until it reached timber line, about December 1, when it died from want of fuel.

On July 22 a fire started in **Boulder County.** Boulder Canyon, near the property of the Alaska Gold Mining Company. Lack of material to feed on stopped it within forty-eight hours, but the timber of the canyon was destroyed over a distance of four miles.

On September 14 a conflagration began at a hunter's camp in a gulch at the foot of Woodland Mountain, near Eldorado, just above Quigley's saw-mill. It destroyed all the timber in township 1 south, range 74 west, and touched the adjoining townships. It ceased about October 10, after having denuded a district of some *forty-four square miles*, which contained the finest timber in Boulder County. The watershed of Middle Boulder Creek has been burnt to bed rock, and the sources of South Boulder Creek have been laid bare. The result must be disastrous to the farming interests of Boulder Valley. There is no tree cover left to prevent spring floods, and there will be no snows to feed the creeks during the late summer months; hence there will be no water for late irrigation. The Denver papers claim that this fire was of incendiary origin, but it does not appear that any arrests have been made.

On September 22 a fire started in the Silver Lake district, near Sunnyside, four miles east of Ward. This also was of incendiary origin. It ran over an area of *twenty square miles* and burnt itself out in ten days.

Boulder County is now practically a mountain desert. Timber for mining purposes will have to be brought from afar, and we may expect to hear of an appeal for aid in the establishment of reservoirs within a year or two.

Clear Creek County. On September 26 the park between Santa Fé and Big Chief Mountain was discovered to be on fire. This conflagration was of incendiary origin, and the parties having been brought to trial, two of them were fined *ten dollars each*. But for the efforts of the state timber appraisers and the county officials, the damage would have been very great. As it was, over *fifteen hundred acres* were burnt over.

October 21 a fire started on the south slope of Leavenworth Mountain, four miles above Georgetown, denuding about 100 acres. Employés of the State Land Board, assisted by resident miners, kept it from spreading into the large timber of the main range.

Eagle County. On September 28 a fire started on the mountains near Lime and Willow creeks, in the neighborhood of Red Cliff, from sparks scattered by a saw-mill which is operating there. An area of *thirty-four square miles* was denuded. The mining interests of Leadville will be severely affected, for the reason that this district hitherto supplied all the timbers used in that important center.

Larimer County. On July 11 a fire started at a point on the western slope of the Medicine Bow Range, 24 miles west of Loveland, in a locality containing the heaviest timber remaining in the state. This tract is forty by sixty miles in extent. Fortunately, only about 1,740 acres were denuded, but the loss was 12,000,000 feet of standing timber, 11,000,000 of which belonged to the federal government and 1,000,000 to the state.

The Western Slope. The counties of the western slope which suffered so severely last year had but slight damages to record during 1901. The people are determined that fires shall be stamped out.

General Results. Approximately *one hundred square miles* of timber lands were laid bare during the summer of 1901. There is now not a single county in the state which does not show continuous fire scars. The state government officially

says that a timber famine is imminent, and that recourse must be had to a reservoir system if the irrigated lands are to be watered according to their needs.

If the results of this destruction affected the people of the commonwealth alone, it might be said that, as they suffer from their own indiscretion, nothing further ought to be done in the matter. But Colorado is the mother of rivers. The fires at the headwaters of the Platte, the Arkansas, the Rio Grande, and the various water-courses combining upon the western slope into the river system of the Colorado del Occidente affect the nation at large. These streams are fed by the snows that whiten the Great Divide or by the springs emanating from them. With the tree growth stripped from the water-sheds, the snows will be melted by the first heat of summer, and the water will rush in torrents down the shallow beds of the Missouri, to the destruction of farm lands and homesteads; and there are no true glaciers in our mountains which might supply a flow in the later part of the seasons. When once each year's snows are melted, the supply of water is gone and the flow must stop.

The remedy for all this destruction and waste lies in the hands of the federal government. The government is the owner of the soil, but it pays no taxes. The mountain counties are poor. The state government, although anxious to prevent losses, is but rarely able to expend any money upon matters not strictly utilitarian, or what may be considered as such by the party which happens to be in power. The new law is working well, and the State Land Board has done all it could; but it is not only hampered by want of jurisdiction over the federal lands, but also by a continuous lack of funds; therefore the federal government ought to care for its property. That it is able to do this is proven by the admirable results achieved in its management of the reserves. All of the timber lands, both within and outside of the forest reserves, should be placed in charge of the Bureau of Forestry, the superintendents, supervisors, and rangers put under civil service rules, and the law rigidly enforced. There is

now much laxity in this regard. The courts do not take hold of trespass and arson cases where only the property of the public is concerned as they do when individuals are wronged. All of this could be achieved out of the revenues created by a rational management of the forest lands. The need is apparent. All the reservoirs that can be built will not store water in the effective manner which is provided by the forest cover. In Algiers and Tunis can be seen the

remains of magnificent reservoirs, perfectly dry, built two thousand years ago by the Roman Government. These reservoirs cannot be filled, because the denuded mountains will not let precipitation fall and because evaporation is abnormal. In Colorado the evaporation now is about 65 inches annually; it becomes greater as the yearly temperature rises. A preservation of the remaining forests, therefore, is of peremptory necessity.

THE PLANTING OF EXOTIC TREES IN SOUTHERN FLORIDA.

PART I.

BY DR. JOHN GIFFORD,

New York State College of Forestry.

ALTHOUGH no part of Florida is south of the Tropic of Cancer, and although no part of it is absolutely free from the danger of frost, the vegetation of that part of the state south of a line from Cape Canaveral on the east to Charlotte Harbor on the west is distinctively West Indian in character. Although the danger of frost produces an uneasy feeling, it seems to be the case that those regions of the world which are just outside of the frost limit, either at sealevel or on the mountains in the torrid zone, are superior for the production of certain vegetables and fruits to regions which are hotter or colder.

This may be due to two circumstances: first, the meeting of two distinct vegetal zones, and, second, a slight check in vegetative growth rather favors the production of seed and fruit, and also perhaps the storage of starch. The first produces a greater variety and the second a greater quantity of useful materials. By a cool check I do not mean either a frost or a freeze, but a temperature of about forty degrees for a short period of time, which is sufficient to stop vegetative activity. This does not apply as much to wood or to rubber as to fruits, such as those of the genus citrus or coffee. It reduces, however, the amount of

weedy growth and checks extreme luxuriance of growth, which is often a hindrance to the practice of forestry.

Florida is the southern limit of several northern and the northern limit of many southern species. The range of a few trees extends through Florida into the West Indies and Central America. The most notable of these are the Live Oak (*Quercus virginiana*), the Cuban Pine (*Pinus heterophylla*), and the Red Juniper (*Juniperus virginiana*). The Southern Red Juniper is considered a distinct species by many botanists, although the distinction is imperceptibly slight. The Cuban Pine seems most at home on the mountains of Guatemala and Honduras.

There are those who believe that it is best to enhance and unfold the native beauty of a region rather than decorate it with imported ornament. There are also those who believe that the proper thing to do, regardless of ornament or sentiment, is to introduce those species from all parts of the world which will grow best and produce the largest quantity of the most useful materials. There are many Australian, African, and Indian species of trees which will grow in Florida, and both the federal and state governments would be neglecting a



KUKUI NUTS (*Aleurites moluccana*). WHEN STRUNG ON A BAMBOO STICK BURN LIKE A CANDLE.

plain duty were they to neglect introducing and experimenting with exotics. Both the arid regions of our west and the coastal plain of our south are in need of considerable government coöperation. A tropical experiment station has been established at Miami, Fla., and there is every reason for hoping that this may develop into an active center for the distribution of valuable exotic trees.

The planting of trees yielding other products than fruit has been neglected in Florida. Tropical Florida covers a

much larger area than many suppose. It is larger than Vermont, or New Hampshire, or New Jersey. There are at least 10,000 square miles in Florida capable of producing tropical products. (Porto Rico contains only 3,550 square miles.) Although in this territory there is some danger of frost, it has great advantages in that it is a part of our mainland, easily accessible and in very direct communication with the markets of the north. It is also a well watered territory, where water may be easily applied during periods of drought. It

is distinctively a forest country, eminently fitted for the production of wood. Rob it of its forest, and you will not only rob it of much of its beauty, but you will expose a soil which is naturally rather sterile to the abusive action of the elements. Already, owing to the wholesale removal of the Sand Pine (*Pinus clausa*) from the great sand dune along the east coast for plantations of pineapples, the air is at times literally charged with a silicious dust, which is the most unpleasant feature of travel in that region. There are large areas in Florida which, it seems to me, are in great need of the shade and protection which trees afford.

Among those trees worthy of introduction into or more extensive culture in Florida, the following deserve first place, or are at least worthy of a trial. I do not mean to suggest merely the planting here and there of a few trees, but acres and acres, so that Florida may become in time famous for the beauty, variety, and productivity of her forests, as well as a land of fruits and vegetables.

Eucalyptus. There are no doubt many species of this remarkable Australian

genus which will grow in southern Florida. One may see large specimens of eucalyptus trees even in very remote places, such as the Isle of Pines. Outside of its home, it is most abundant in southern Europe, Algeria, South Africa, and southern California. *Eucalyptus rostrata*, or Red Gum, is my favorite. It is a very hardy and valuable timber tree. It is fast growing, erect in habit, and on the whole a tree of great beauty. Its wood is hard, strong, durable, and reddish in color. In South Africa it is called "the farmer's friend." It grows in damp places, especially on the river flats of eastern Australia, and will probably do very well, if properly tended, on the edge of the Everglades and other swampy districts. It is a very effective drainage agent, every tree acting as a powerful pump, since the quick-growing leaves and shoots transpire tremendously in the sun of the tropics. A gum called "Red Gum," which is extensively used in medicine, is manufactured from this tree. It is probably the best known of the Gum Kinns of Australia. Seeds of this species may be easily secured, either from our seed dealers or can be ordered from reliable firms in Europe or Australia.

Melaleuca leucadendron (Cajeput Tree or Fever Tree) is a tree of Australia which has been strongly recommended for planting in damp malarial regions. This tree yields cajeput oil, which is much used in medicine. Baron von Mueller says that "it deserves especial attention as a tropical tree, fit to grow in malarial swamps, and containing in its foliage antiseptic and anti-miasmatic oil. It will grow where no *Eucalyptus* can be reared."

In the light of modern discoveries in reference to malaria, it is, of course, improbable that these trees exert any very marked influence for



CASUARINA EQUISETIFOLIA.

good in that line, except in draining the soil, which certainly tends toward the reduction of the mosquito pest. The presence of trees of any kind prevents the stagnation of water.

Aleurites moluccana (Indian Walnut or Candle Nut). This tree is common throughout the tropics. It is a favorite shade and street tree in many tropical cities. It is very abundant in the Sandwich Islands. Its nuts produce large quantities of oil, which is extensively used as a drying oil for paints and varnishes. I have heard it said that fully 10,000 gallons are produced each year in the Hawaiian Islands. The nuts, when strung on a bamboo stick, burn like a candle. The accompanying illustration is by Mr. H. W. Henshaw, of Hilo. The tree which yields such a useful oil and which is so easily propagated deserves to be much more extensively planted.

Scattered almost everywhere throughout the tropical coast towns of the world one sees *Casuarina equisetifolia*. At Palm Beach, Miami, and other Florida towns this tree has been extensively planted and is growing with magical rapidity. It is sometimes called the Toa Tree, and is also known as Beefwood. It is one of the most valuable forest trees of the world. It is easily propagated, grows rapidly, and in places where few other trees would thrive. It is extensively used in various parts of the world for the fixation of littoral dunes of sand. Plantations of this tree on the Madras coast are now beautiful and valuable forests. By its vigorous growth it has fixed the sands in a permanent manner. Its pliant, drooping limbs and foliage give with the wind and are in consequence uninjured by tropical gales. It will grow on the beach close to the salt water of the ocean. The accompanying illustration shows the hairy foliage and peculiar habit of the tree. It is said that it was called *Casuarina* because of the resem-

blance of its leaves to the feathers of the cassowary. It is of interest to note that the tree really has no leaves, but that the foliage consists of green thread-like, feathery, jointed branchlets. There are several large trees in Key West, and if it continues in favor as at present it will soon be one of the commonest trees of the Florida coast. It is called also the She Oak. (This tree should not be confounded with the Silk Oak of Australia, *Grevillea robusta*. This is a tree of great beauty, with orange-colored flowers in racemes, and frond-like leaves, which also grows well in Florida, but the wood is not of extra quality.) The She Oak probably belongs somewhere in the order Amentaceae, to which the oaks and walnuts belong.

Cinnamomum camphora, the Camphor Tree. This tree has often been recommended for planting in our south. A circular (No. 12) of the Division of Botany, United States Department of Agriculture, was printed on the subject



CAMPHOR TREE, SANTA BARBARA, CALIFORNIA.



CORK OAK NEAR SAINT RAPHAEL, FRANCE.

in 1897. This tree grows well in cultivation under widely different conditions. It has been naturalized in Madagascar; it grows well at Buenos Ayres, in Egypt, southeastern France, Canary Islands, and to some extent in California. It is common in the Philippines, Formosa, and Japan. It is at home in Formosa. I noticed a thrifty Camphor Tree in a private garden in Cuba. There are some fine old Camphor Trees near Cape Town. Large trees are growing in the temple courts in Tokio.

In speaking of this tree for South Africa, Forester Hutchins mentioned a fact which is too often overlooked. "The Camphor Tree is strongly shade-bearing. It is the most shade-bearing

of all the exotic timber trees hitherto introduced to South Africa." The Camphor Tree might be used to improve and restore some of the depleted forests of our Gulf coast and Atlantic coastal plain as far north as South Carolina. In addition to yielding camphor, which is one of the most useful of all minor forest products, the timber is excellent for the manufacture of chests and other purposes. There is value in every twig. The wood is easily worked, light, durable, and free from insect pests. I can see no reason why the Camphor Tree should not be extensively grown throughout the whole of the State of Florida.

Quercus suber, the Cork Oak. Few of

us realize that the cork of a champagne bottle is worth more than the bottle. One may see large cork forests in southern Europe, especially in Spain, and also in Algeria, and I know of no reason why it should not be grown in our own south. The removal of the bark does no injury; on the other hand, it is said it facilitates growth. The illustration shows some Cork Oaks in southern

France, from the large limbs and the trunks of which the cork has been recently removed. These old trees yield cork for a long period of time, although one must wait several years before the first harvest. In the sandy pine lands of southwestern France the foresters are always elated when they can induce a species of Cork Oak (*Quercus occidentalis*) to grow satisfactorily.

EARTHEN RESERVOIRS.

BY ARTHUR P. DAVIS

U. S. Geological Survey.

SOMETIMES a farm is provided with a small water supply in the form of a well, equipped with a pump, or a small spring, furnishing insufficient flow for convenient and economical use in irrigation. In such cases it is necessary to have a small reservoir, so that the water can be accumulated and afterwards distributed upon the irrigated land in a larger stream than the supply would furnish continuously. Such a reservoir must be located above, or but little below, the surface of the ground, as it is necessary to draw the water off by gravity onto the land to be irrigated. It may be constructed by building a small levee or dike three or four feet in height, of such form as is suited to the contour of the ground where it is located. The surface soil should first be removed, in order that there may be no great amount of grass, roots, or other vegetable matter either in the reservoir or along the embankments surrounding it. The bank should be built of loamy earth that may be compacted into an impervious body, and should, if possible, have a considerable admixture of clay and of sand. It may be placed in position by scrapers, and compacted by the trampling of horses or other animals, or by the use of a roller, the bank being kept moist to facilitate the consolidation process. The height of the bank, of course, will be such as will give the required capacity of storage, and will be greater on the downhill edge of the reservoir than on others. At the lower end or corner a

pipe will pass through the bank (preferably of iron), with a suitable valve, by which means water may be drawn off when needed for irrigation.

Particular pains will be necessary to form a joint between the iron and the earth, so that the water will not follow the junction and cause a leak. The best practice is to imbed the pipe in concrete, the rough edges of which will make a good bond with the earth embankment.

Such reservoirs as are practicable of construction on the above plan can be made available only where it is desired to accumulate the water into an irrigating head, or to save the night flow for use in the daytime, or to store a few days' supply until the time when most needed. As a storage of storm waters, or to hold irrigation water for any considerable period, such a reservoir is impracticable. Its relation of depth to area is so small that the evaporation is rapid, and this, together with the percolation to be expected, soon exhausts its capacity. Moreover, the reservoir being entirely artificial, its cost in proportion to its capacity renders it impracticable, unless the capacity is to be utilized over and over at frequent intervals.

Where it is desired to store storm waters for a considerable period of time, as from a rainy season to a dry season, for purposes of irrigation, it is usually necessary to find some point where the construction is assisted by the natural topography, as in a broad ravine or

other drainage line, where banks suddenly approach each other, and where an artificial embankment of modern dimensions will complete the enclosure of a reservoir of considerable capacity, the water supply to be furnished by its own drainage basin or to be led into it by a ditch.

Where it is practicable to build the structure of earth it is usually far cheaper than masonry, wood, stone, or any other construction possible. This possibility is dependent upon the existence near at hand of suitable material for an earth dam, and in a less degree of an impervious earth foundation upon which it may rest. If the dam is not to be high, it is possible to safely construct it of earth upon a rock foundation by taking particular pains to make a tight bond between the earth and rock; but it is a difficult matter, and where its height will bring a heavy water pressure to bear it is usually not practicable to make a sufficiently tight bond between the earth and the rock. In such a case an earth dam may be built with a masonry core carried a short distance down into the rock and built up through the center of the dam as high, or higher, than the water surface is to be.

Where the foundation is of earth this should be stripped of all organic matter down to a reasonably compact loam or clay, and the earth placed in the embankment should be freed from all organic matter. The ideal mixture for the bank is clay and sand and gravel in approximately equal parts, or in any proportions such that no one of the three shall constitute less than 20 per cent. nor more than 60 per cent. of the bulk. In general, the finer materials and the larger proportion of clay should be placed in the center of the dam and the side next the water, while the larger proportion of gravel should be in the down-stream half of the dam. These materials may be placed by scrapers or carts, and should not be dumped in piles, but should be scattered in layers from 4 to 6 inches in thickness, and sprinkled with a hose or sprinkling cart, so as to make them thoroughly moist, but not so wet as to constitute what would be

called mud. While in a moist condition the material should be well trampled or compacted by rollers. An ideal method of construction is to bring the material into place by means of scrapers, and to have a heavy sprinkling wagon, drawn by four horses, the wheels having wide tires and so arranged as not to track. The sprinkling cart then becomes a roller, and, together with the trampling of the men and horses handling the scrapers and the team drawing the cart, performs the office of compacting the embankment. The wagon should be kept moving and performing the function of a roller, even though continuous sprinkling is not required.

Where the material, and especially the clay, is sufficiently abundant, such a structure may be made virtually impervious. In case the clay is scarce or must be hauled a long distance, it may be found advisable to build a core of carefully selected materials, mixed with a proper amount of clay and carefully "puddled"—that is, moistened, mixed, and compacted. The rest of the dam may then be made of coarser materials, reliance for impermeability being placed upon the puddled core. The foundation of the dam should be rendered rough, so that there will be no definite horizontal joint between the dam and its foundation. This may be done by plowing deep furrows across the ravine, or, still better, by digging deep trenches parallel to the axis of the dam. The top width of the dam should be not less than five feet, and wider for higher dams. A good formula is five feet plus the square root of the maximum height of the dam.

The slopes of the dam should be sufficiently flat so that there will be no danger of the earth rolling down the slopes—that is, they must be flatter than the "angle of repose" of the material of which it is constructed. Conservative slopes are 3 horizontal to 1 vertical on the water slope, and 2 horizontal to 1 vertical on the down-stream slope. Steeper sides may be given where the material is especially favorable and where important wave action is impossible; but it may be said that the water slope should not be steeper than 1 on 2,

nor the down-stream slope steeper than 1 on $1\frac{1}{2}$.

Where the lake to be formed is of considerable extent, so that wave action is likely to occur, it is advisable to pave the water slope with rock carefully laid in place by hand, to prevent the direct action of the waves upon the earth. This is especially necessary where the slopes are steep.

Where there is great danger of borings by gophers or other small animals,

the dam should be provided either with a masonry core or with a tight pavement on its lower slope. This tight pavement may be made similar to macadam.

Cast-iron pipe should be laid through the dam for the purpose of drawing off the water, provided with suitable valves, and surrounded by a bed of concrete to insure proper junction with the material of the dam, which should be very carefully puddled and rammed about the concrete.

MAPLE PLANTATIONS IN VERMONT.

BY GEORGE H. MYERS.

SOME twenty-seven or twenty-eight years ago prizes were offered by a certain "Grange Society" for the best plantation of Hard Maple in the town of Pomfret, Windsor County, Vermont. As a result a number of small plantations were made, seven of which remain and were examined during the past summer by the writer.

In size the plantations vary from one-half to fifteen acres. The object in making them, aside from the desire to win the prize, was in all cases to establish a sugar orchard. The ground selected for the plantation was in most cases side-hill pasture land of little value at the time of planting. In some cases the slope was so steep or the grass cover so thin that washing and gullying had already begun, and the soil was poor, thin, and rocky. In every case but one, however, the lower slopes of the hills were chosen, probably because of their greater accessibility in working the future sugar orchard. In obtaining the stock for planting, the method varied somewhat as to the care exercised, but was in the main as follows:

Two men with a wagon went into the nearest woodland where maples were growing and selected young trees from six to eight feet high. In some cases the trees were lifted by forcing down an iron bar beside the tree and using it as a lever until the tree could be pulled up by the top. It was then placed in a wagon with more or less of

the soil adhering to the roots. In other cases somewhat larger trees were used and were gotten out by hitching to the top a chain drawn by a team of oxen or horses and pulling until the roots broke. Then the more or less mutilated top was cut off and the trees put into the wagon. When a load was obtained the trees were carried to the planting area and dropped at intervals of from fifteen to twenty feet each way.

Sometimes the trees were set in separate holes, and sometimes they were set in a twice-plowed furrow, and the roots laid into it without much care. It was impossible to discover whether the planting was all done in cloudy weather, but such was probably the case. In one instance the trees were dug up one day and set out the next, without much care between times. In another case, that of the largest plantation, where the stock used was six to eight feet high, the land planted was used as a sheep pasture for ten years following the planting, and since that time as a cow pasture.

Such errors in method, due to carelessness and ignorance, have not had so serious an effect as might be expected, because the species is a hardy one, and the locality is extremely well suited to its growth, as is shown by the size attained by the original growth and by the abundance, general thrifty condition, hardihood, and tolerance of the second growth of this species in the vicinity.

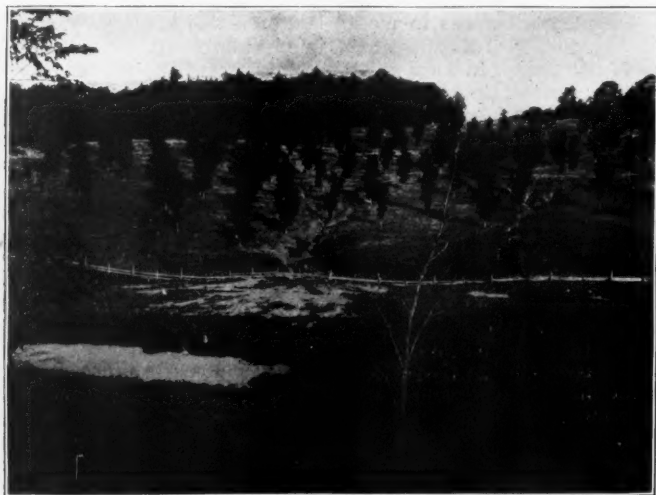
The cost of planting is difficult to ascertain exactly, as no records were made, and information rested merely upon the memory of those who did the planting. The value of labor is, and probably was at that time, \$1.50 per day, and that of a horse fifty or seventy-five cents. The cost of planting would thus appear to be considerable, in view of the fact that only about one hundred trees were planted by each man per day; but the work was often done at odd times, which would otherwise have been wasted. No cash expenditure was incurred for labor, and none of the plantations have received any attention since their establishment.

The present condition of these plantations is shown in the accompanying photographs. There are numerous "blanks." Grass is growing everywhere between the rows, except in small spots. There has been no lateral crowding, and the trees are therefore spreading and low-branched. On the steep slopes the leaf cover and root growth have been entirely insufficient to prevent washing of the soil. Nevertheless the owners seem to be satisfied with the results, and the writer was told that a farm containing one of these future sugar orchards about four acres in extent had

recently been sold for \$200 more than it would have brought without the maples.

On the Frederick Billings estate, in Woodstock, the town adjoining Pomfret on the south, several maple plantations of a slightly different character were made about twenty years ago, the largest being ten acres in extent. The stock used consisted of plants one foot high, secured in the neighboring woods, and set from thirteen to twenty-one feet apart each way in a piece of good hay land on a northeast slope, well protected on the south and west by high timber. The cost of this planting was \$2 per acre. After the planting the grass was cut on the plantation to the value of \$10 an acre per annum for ten years, since which time the grass crop has decreased, until at the present time it barely pays the expense of cutting.

The trees are for the most part stag-headed, sun-scalded, and much injured by scythe wounds at the base. Six or seven years ago White Pines were planted in rows between the rows of maples, reducing the distance between the trees by one-half in one direction, but not at all in the other. The white pine stock used consisted of three or four year old transplants. Although they grew slowly at first they are now



SCENE IN TWENTY-EIGHT YEAR OLD MAPLE PLANTATION, SHOWING WASHING AND GULLYING DUE TO WIDE PLANTING.

doing excellently, in some cases growing 2, or even 3 feet in height in a year.

The above information shows that very poor judgment has been exercised in planting, and that there has been, and apparently is now, an utter lack of appreciation of the value of bringing about actual forest conditions in artificial plantations in this section, though it is occupied by well-informed and intelligent American farmers. The one primary fact that entirely escapes them (not to mention details of unskillful planting) is the fact that grass and forest trees are antagonistic types of vegetation and cannot be grown with any striking degree of success upon the same piece of ground at the same time.

Their idea seems to be that as a com-

from the thinnings would produce immediately at hand the necessary fuel for boiling down the sap, while the above-described orchards will be dependent upon an outside source for fuel for this purpose.

The effect of grazing is undoubtedly injurious in hardening the surface soil and in causing a more rapid run-off of the water. Still more injurious is the failure of the trees to form at an early age a continuous leaf canopy, which would help to retain the moisture and tend toward the formation of a good layer of humus and the prevention of soil washing. The beneficial effect upon forest growth of retaining the moisture in the soil, even in this region of abundant and well-distributed rainfall, is



THIS VIEW SHOWS BAD EFFECT OF WIDE PLANTING IN EXPOSED SITUATION.

plete stocking is not advantageous in the mature orchard, it is therefore unnecessary and unwise to plant a much larger number of trees than they wish to have at maturity. This idea is supported by the lesser cost of such planting, as has been described, by the fact that trees with full crowns and plenty of space about them are more often "good sap trees," and also by the necessity of having considerable room in which to work during sugaring time. The farmers lose sight of the fact that while the young trees are developing into sugar trees—that is, trees of about ten inches in diameter, breast high—it is better for them to mature under normal forest conditions; also that the wood obtained

well shown by the fact that in these plantations trees growing in slight hollows or in situations locally protected from the wind show better growth than those next to them on slight knolls. In general, for the Hard Maple, as well as for many other species, a proper degree of moisture is more important than a rich soil.

After seeing the poor condition of these artificially planted trees it was interesting to examine results of some thinnings on small areas of volunteer second-growth maple in the adjoining town of Barnum. The rate of growth on the remaining trees after the thinnings were made was greatly increased, which shows that labor can be much



VOLUNTEER STAND OF PURE MAPLE TWENTY TO TWENTY-FIVE YEARS OLD, BADLY IN NEED OF THINNING.

more economically expended in utilizing and improving this natural growth which is to be found in patches of varying size on almost every farm in Windsor County, rather than in trying to establish artificial plantations of maple on waste pasture land. For this purpose volunteer seeding of Red Spruce or White Pine is much better adapted for many reasons. The work of thinning natural or volunteer growth is simple,

requiring nothing but common sense, such as is possessed by the average farmer in this locality. Planting, on the other hand, to be successful, requires a knowledge of the principles of forestry, which is at present rarely to be found. For these reasons it is hoped that in future more attention will be paid to the thinning of volunteer second-growth maple, such as is shown in the accompanying illustration.

LIGHT OUT OF DARKNESS.

BY GUY ELLIOTT MITCHELL,

Editor The National Homemaker.

TWO years ago the eastern half of the United States knew practically nothing of irrigation in the West or of the possibilities lying in the reclamation of arid America. It was hardly known that irrigation was practiced in this country. Eastern papers published little or nothing on the subject. Editors considered that an article submitted to them descriptive of the ancient irrigation systems of Egypt, Syria, or Peru

was of more general interest to their readers, and published it in preference to accounts of the wonderful irrigation works of California and Colorado. Now and again, when the question of the reclamation of the Great American Desert was discussed in a Sunday issue of some of the large dailies of the East through the medium of some facile pen, the subject appeared as one of those fancy sketches of the distant future—an im-

aging of a later period of the world's existence, when conditions shall have been well rounded out, when rapid transit shall have been reduced to a science far beyond the railroad achievements of today, when we shall be skimming through the air in ships, when living shall have been reduced to an exact science, with no waste, but with the utilization of every product and of every particle. It would be natural, looking ahead to this time, when every resource would be fully utilized, that all the waste water of the West should be conserved and made to produce crops. This was about as seriously and as practically as people in general took the question of the irrigation of the desert.

There has come a change. The eastern half of the country is beginning to realize what the reclamation of the great empire west of the Missouri River would mean, and that it is a question of the day. Newspapers and magazines now publish many popular and interesting illustrated articles showing the great work which has already been done in irrigation, even as a beginning, and the magnificent results which would follow the watering of the 100,000,000 acres still susceptible of reclamation. The figures which can describe these results are large ones. Fifty million people, it is estimated, would occupy this western empire, and \$1,250,000,000 has been a low estimate of its annual output. The addition to the national wealth would therefore be an enormous one. For many years this part of the country would depend almost exclusively upon the eastern half of the United States for its manufactured products, and the market which it would afford to our manufacturing states would, of course, be the best they could desire.

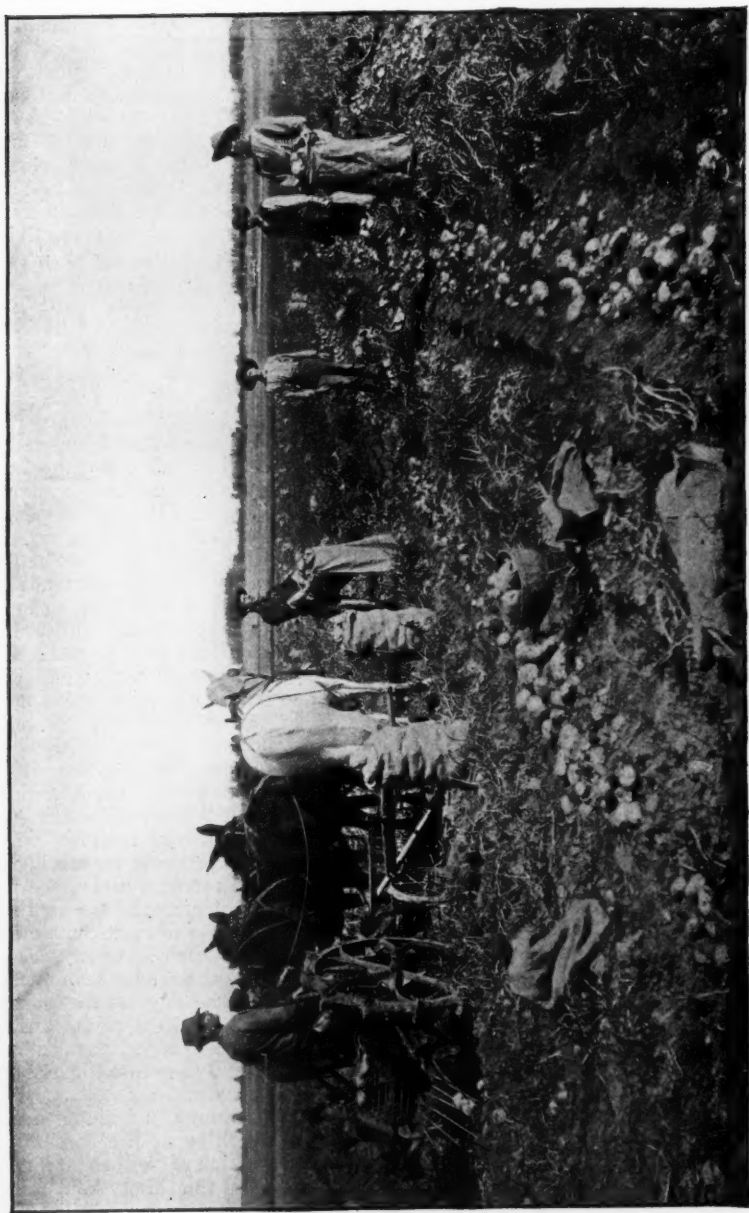
This fact the press of the East has been quick to emphasize. From one cause or another the papers of the country—those greatest of public educators—have come to consider the irrigation subject as a legitimate news question. The consequence is that more and more is being written about it and more and more people are learning of it.

Most of the eastern papers have adopted the broad view that the con-

quest of our deserts is a great national question; that inasmuch as private capital has about reached the end of its endeavor, and that as the general government is the only party which can properly treat it, it is fitting that Congress should take up the problem and proceed to the reclamation of the arid lands in a systematic manner, reserving the lands for the use of actual settlers and home-builders, in small tracts sufficient for them to make a living from for themselves and for their families.

Some few of the papers of the East and of the Mississippi Valley have assumed the position that these lands should not be opened and brought into competition with eastern farms; but this is very generally condemned as a narrow view. As well, it is answered, might the original thirteen states have decided that no additional territory should be developed because it would come into competition with them. Moreover, this claim is born in ignorance, for the irrigating of these western areas would not compete with the eastern farming interests, but, on the other hand, would benefit them. In the first place, this opening of western lands would be a slow and gradual process, covering a period of many years. In the next place, the products of this region would not compete with the products of the eastern farmer. Most of them would be consumed in the West itself by the great mining and industrial interests which would be developed—for its mining industry is yet in a state of infancy—while any surplus which might be produced would naturally go to meet the anxious demands of the Orient. Lastly, the demand of the West upon the manufacturing East would be so great that eastern factories, doubled in capacity, would furnish, with their added thousands of employes, a vastly increased market for the eastern farmer.

Thus the country as a whole begins to know something of the possibilities of the reclamation of the barren wastes, the marriage of the thirsty lands to the flood waters, the conquest of this inland empire, the subjugation of the desert, the annexation of arid America.



RESULTS OF IRRIGATION ; VIEW IN A POTATO FIELD NEAR GREELEY, COLORADO.



VIEW IN A POTATO DUGOUT.

THE EFFECT OF ICE STORMS ON TREES.

BY HERMAN H. CHAPMAN.

ON the night of Friday, February 21, a storm swept over the Atlantic seaboard, accompanied by rain which froze as it fell, forming a coating of ice on every exposed surface. The effect of this storm on trees in some localities was so severe as to be worth study, as such storms are not infrequent and occur even as far inland as Kansas. Observations taken on the north shore of Staten Island showed sound limbs up to four inches in diameter broken from Elm, Beech, Tulip, Poplar, and Black Oak. Birch trees up to eight inches thick were bent over to the ground. White Oak alone resisted serious damage by the great strength of its branches. In many cases all the limbs of a tree were broken and the crown reduced fully 90 per cent. The greatest damage was done in culled timber, where the old trees had been left isolated. Much of this was rotten and did not stand the test, unsound limbs up to a foot in diameter being torn from the trunk. The damage was greatest where the wind had a sweep.

To calculate the forces which caused such destruction, a number of twigs were cut transversely and diagrams made of the thickness of the twig and the ice incrustation. The ice is of about the same weight as the wood of a green twig. Calculating from the relative area in cross-section, it was found that twigs one-eighth of an inch thick were carrying from thirty to forty times their weight of ice, those one-fourth of an inch thick twenty times their weight,

and those one-half of an inch thick five times their weight. While the exact calculation would be rather difficult, it is safe to say that branches one-inch thick were called on to support a weight over ten times as great as usual and possibly twice this much.

In addition to this enormous burden, the surface of the crown or branches was increased over fivefold, thus multiplying the effect of the wind by that factor. The wonder is that any limbs were left.

Forest trees depend very largely on one another for protection from such unusual conditions. Where the trees grew thick and undisturbed, the protection from the wind was so complete that much fewer and smaller branches were broken; but where man had stepped in and "improved" the woods, by cutting out the underbrush and saplings and leaving only the "grand old trees in their majestic beauty," Nature took especial pains to point out the error of his ways, and most of these grand old trees are now more fit for scarecrows than for shade. That wind and ice are not the only enemies that "improving" gives a chance was shown by the fact that nearly all the limbs broken off showed rot in their interior. The drying soil, the grass, and the exposure following thinning had already gotten in their deadly work, and it needed only the storm to reveal it. If man wants a park, let him keep the whole wood, or raise a new one. "Improvements" are seldom accepted by Nature.

PUMPING WATER FOR IRRIGATION.

THIRD PAPER.

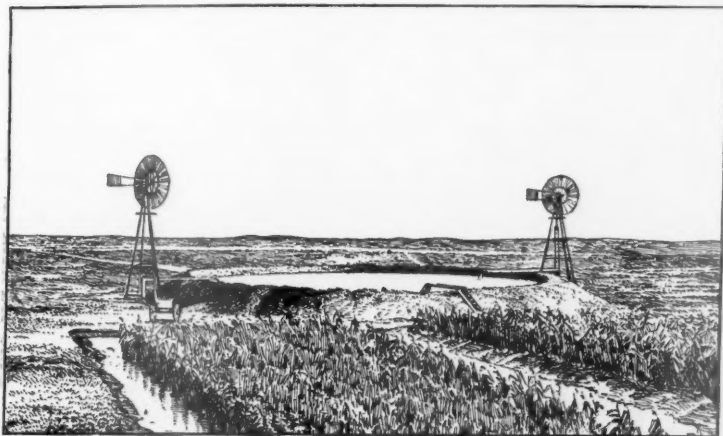
THE arrangement of windmills for pumping water for irrigation is illustrated in the drawing accompanying, which gives a view of an earth reservoir built nearly circular in form.

The two windmills which supply the water are placed upon opposite sides, in order that the pumps may be as far apart as possible. In many instances three or even four mills, each of mod-

erate size, are placed around a reservoir of considerable size. The banks, made of earth, are covered with sod to protect them from washing by the rain and by the waves during times of high winds.

The drawing of the steel windmill and tower carrying a tank represents an adaptation of a windmill for use in domestic water supply or for furnishing water to a village or small town under considerable pressure. The wind engine is erected on the top of a high steel tower, which also supports a wooden tank with suitable cover to protect the water from loss by evaporation. This

The merit of the device is its cheapness. It may be built mainly of old lumber and other material that can often be found about the farm, such as axles or other gear from old farm machinery, bale wire for staying the sails, and pieces of wood or metal which may be classed as old junk. The machine cannot be recommended on the ground of efficiency or economy. If a farmer has sufficient capital to purchase and erect a good windmill, he will undoubtedly succeed better than by spending his time in making the cheaper device. On the other hand, in situations where, as is often the case in a dry region, the



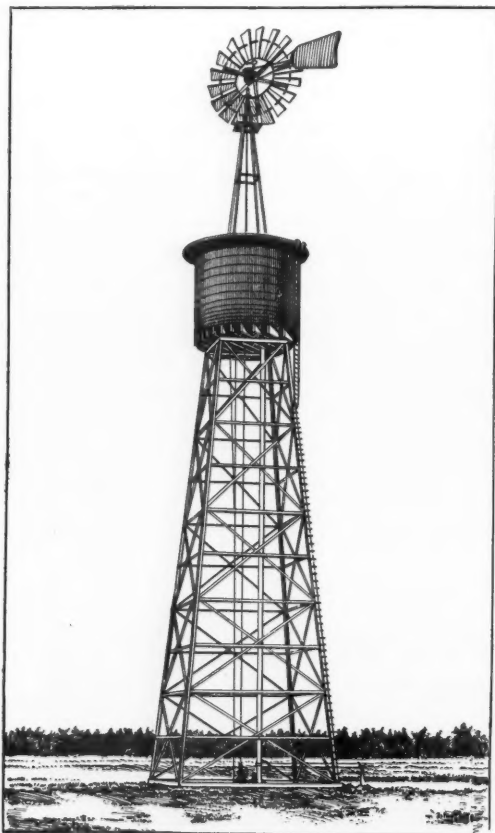
WINDMILLS AND CIRCULAR RESERVOIR.

device is generally employed by railroad companies at stations on the great plains, where the wind may be depended upon to force a sufficient supply into the tank for use by locomotives or for the railroad shops and offices. Many towns also depend for their water supply for domestic needs and for watering gardens upon a windmill pumping water into an elevated tank, particularly where the general surface is so nearly level that it is impossible to construct a small earth reservoir within reasonable distance of the principal buildings.

The home-made mill, or Jumbo wind engine, has been employed to a considerable extent in the Great Plains region, and is usually constructed by the owners.

farmer has lost crops year after year, has exhausted his resources, and is on the verge of bankruptcy, a contrivance of this kind may serve to save a small crop and give him a new start. In such instances there usually will be found pieces of broken-down machinery about the farm. Time and labor are commonly of little value where the ordinary farming operations have been unsuccessful, so that by the exercise of a little ingenuity the material and energy that otherwise would be wasted may be turned to advantage.

The mill or engine consists of a shaft of wood or iron placed horizontally and supported at each end. Upon this sails are fastened by arms extending out at



STEEL WINDMILL AND TOWER CARRYING TANK.

right angles. On each end of the shaft is attached a crank, and each of these cranks in turn drives some simple form of home-made pump. The lower half of the mill is boxed in, and thus forms a small building without roof, above which project the arms carrying the sails.

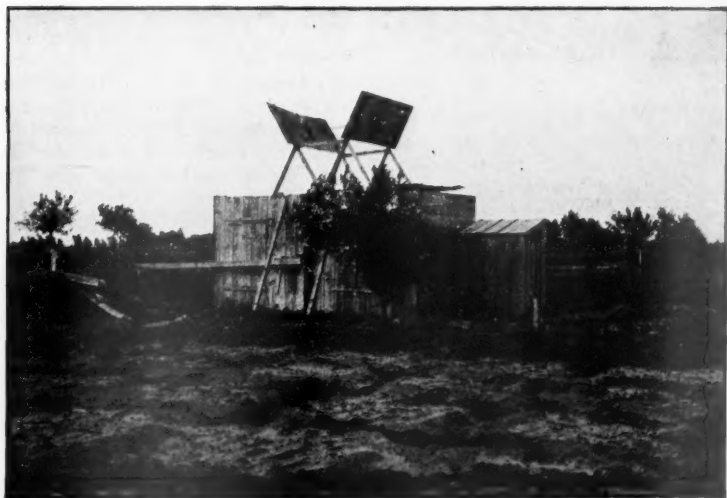
Another home-made device has been introduced. This mill and water elevator, invented by the owner, has been successfully used to furnish water for irrigation; and, although not by any means an economical device, nor one that can be recommended, it has served its purpose. In other words, while, as

a rule, it is economical to purchase the best, there are circumstances and times when for special reasons the best mill cannot be had; but it is still practicable to construct a machine which will accomplish the desired end, that of getting water from the ground upon the land.

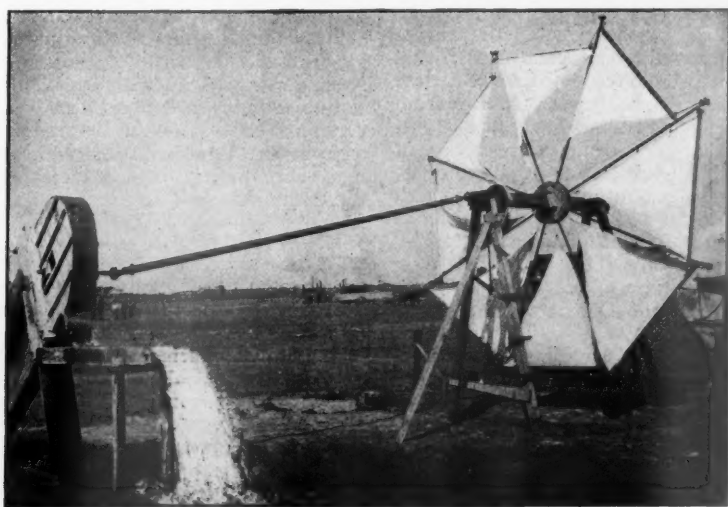
These examples of inventive genius on the farms of the West might be almost indefinitely multiplied, but are sufficient to demonstrate the principle that with energy and ingenuity a start toward irrigation can be made. When, however, some experience has been had in irrigation and newer mills are being procured, it is highly essential for continued success that something better than the ordinary form of mill be obtained. Many of these have been designed for some other purpose than that of raising large quantities of water through a short distance for irrigation. Some, for example, have been built with the idea of pumping a small quantity from great depth for watering stock. Such mills, as a rule, do not fill the requirements of the irrigator. Thousands of windmills are in use and thousands more will be purchased, involving expend-

itures on the part of farmers aggregating millions of dollars. A saving of even a small percentage in cost of repairs is a matter of considerable importance to the irrigators of the country in the continued use of the water.

If a farmer is able to buy a windmill and pump he should get the best, as the first cost is about the same for different makes; but the economy of repairs is far different. In subsequent articles the attempt will be made to give the experience of practical irrigators in using various styles of machinery, pointing out the benefits of each under certain conditions.



HOME-MADE WIND ENGINE, AS USED ON THE GREAT PLAINS.



DEFENDER WINDMILL AND WATER ELEVATOR.

FORESTRY AND IRRIGATION IN CONGRESS.

MONTH OF FEBRUARY, 1902.

February 1.

Resolution of the Pennsylvania State Board of Agriculture, Harrisburg, Pa., in relation to the sale of public lands, the manufacture of oleomargarine, and the irrigation of the arid lands, introduced in the House by Mr. Burk.

February 3.

Resolution of the Owosso Federal Labor Union, No. 9056, of Owosso, Mich., favoring the government irrigation of public lands. Petition of the Lansing (Mich.) Typographical Union, No. 72, relating to the desert-land bill, the irrigation bill, and public land for settlers. Also petition of 26 citizens and land-owners in the district of Koolau, Maui, Territory of Hawaii, against the granting by the United States Government, or by the Territory of Hawaii, to any corporation or individual, of the water privileges. To the Committee on the Territories.

February 4.

Resolved by the Senate (the House of Representatives concurring), that there be printed 10,000 copies of Senate Document No. 84, being a message from the President of the United States transmitting a report from the Secretary of Agriculture in relation to the forests, rivers, and mountains of the Southern Appalachian region, of which 2,000 copies shall be for the use of the Senate, 3,000 copies for the use of the House of Representatives, and 5,000 copies for the use of the Department of Agriculture.

In the Senate, Mr. Warren, of Wyoming, introduced a petition of the Retail Lumber Dealers' Association of Wyoming, Colorado, and New Mexico, of Colorado Springs, Colo., praying for the enactment of legislation providing for the construction of a system of reservoirs throughout the arid West for the storage of its surplus waters, to be used for general irrigation purposes; which was referred to the Committee on Irrigation and Reclamation of Arid Lands.

February 5.

By Mr. Kean: A memorial of Pomona Grange, No. 1, Patrons of Husbandry, of Moorestown, N. J., remonstrating against the enactment of legislation authorizing the irrigation of the public lands of the West at public expense.

By Mr. Pritchard, from the Committee on Forest Reservations and Protection of Game, to whom was referred the bill for the purchase of a national park in the Southern Appalachian Mountains, reported it without amendment, and submitted a report thereon.

February 6.

In the Senate, Mr. Penrose presented the petition of Local Union, No. 228, United Brotherhood of Carpenters and Joiners of America, of Pottsville, Pa., praying for the enactment of legislation providing for the preservation of the remaining public lands of the United States for the use of actual settlers and home-builders thereon.

Mr. Platt, of New York, submitted a joint resolution authorizing the President of the United States to invite the government of Canada to join in the formation of an international commission to examine and report upon the diversion of the waters that are the boundaries of the two countries; which was read twice by its title and referred to the Committee on Commerce.

February 7.

In the Senate, Mr. Proctor presented petitions of the Typographical Union, No. 402, of Barre, and of Garment Workers' Union, No. 32, of Brattleboro, in the State of Vermont, praying for the repeal of the so-called desert-land act, that an appropriation be made for irrigation surveys, and remonstrating against the granting of public lands.

In the House, by Mr. Haugen: A bill to provide rules and regulations governing the importation of trees, plants, shrubs, vines, grafts, cuttings, and buds, commonly known as nursery stock, and fruits into the United States, and rules and regulations for the inspection of

trees, plants, shrubs, vines, grafts, cuttings, and buds, commonly known as nursery stock, grown within the United States, which become subjects of interstate commerce or exportation.

By Mr. Bell: Resolution of Fruit Growers' Association of Boulder, Colorado, favoring government reclamation of arid lands.

February 10.

In the House, by Mr. Shafroth: Resolution of the Colorado State Horticultural Society, favoring government reclamation of arid lands.

February 11.

In the Senate, by Mr. Teller: Petitions of the Colorado State Horticultural Society; of the Colorado State Grange, Patrons of Husbandry, and of the Fruit Growers' Association of Boulder County, favoring government reclamation of arid lands.

February 12.

In the Senate, by Mr. Gibson: "I move that the pamphlet entitled 'The Nation as a Land Owner,' by J. D. Whelpley, reprinted, by permission of Harper & Bros., from *Harpers' Weekly*, issues of November 30, December 7, and December 14, 1901, be printed as a document and referred to the Committee on Public Lands. It is an interesting statement of the present condition of the public lands, and also contains something on the question of irrigation." The motion was agreed to.

February 17.

In the House, by Mr. Alexander: Resolutions of the National Building Trades Council of America in relation to the arid-land measure. To the Committee on the Irrigation of the Arid Lands.

February 18.

In the Senate, by Mr. Kean: Memorial of the State Local Grange, No. 8, Patrons of Husbandry, of Moorestown, N. J., remonstrating against the irrigation of the arid lands of the United States at public expense. Also by Mr. Kean: Petition of Federal Labor Union, No. 7211, American Federation of Labor,

of Dover, N. J., praying for the construction of irrigating reservoirs and remonstrating against granting state control to government lands.

By Mr. Beveridge: Petition of the Local Union, No. 652, United Brotherhood of Carpenters and Joiners, of Elwood, Ind., praying for the repeal of the so-called desert-land act, for the commutation of the homestead act, and that an appropriation be made for irrigation surveys, etc.

In the House, by Mr. Tongue (by request): A bill appropriating the receipts from the sale and disposal of the public lands in certain states and territories, to ascertain the extent to which said lands may be reclaimed, and to authorize the taxation of public lands under certain conditions.

February 19.

In the House, by Mr. Lacey, from the Committee on the Public Lands, to which was referred the bill of the House to set apart certain lands in the Territory of Arizona as a public park, to be known as the Petrified Forest National Park, reported the same with amendments, accompanied by a report.

By Mr. Woods: A bill providing the means for acquiring title to two groves of *Sequoia gigantea* in the State of California, with a view to making national parks thereof.

February 20.

In the House, by Mr. Acheson: Resolutions of the Engineers' Club of Philadelphia, Pa., for securing a national forest reserve in the Appalachian Mountains.

February 21.

In the House, by Mr. Rumple: Petition of the Amalgamated Wood Workers' Union, No. 92, Clinton, Iowa, asking for the repeal of the desert-land act and the commutation clause of the homestead act, and urging appropriation for government surveys and construction of reservoirs.

February 24.

In the House, by Mr. Babcock: Resolution of the Board of Trade of La Crosse, Wis., favoring a national park

reservation in Minnesota. By Mr. Rumble: Resolutions of the Muscatine Typographical Union, No. 251, of Muscatine, Iowa, urging the reclamation of the arid lands and the construction of certain reservoirs.

In the Senate, by Mr. Platt: A petition of the American Federation of Labor of Rochester, N. Y., praying for the enactment of legislation providing for the construction of storage works to equalize the flow of streams for the irrigation of the arid lands of the West; which was ordered to lie on the table.

By Mr. Gibson: Petition of J. W. Ward and 182 other citizens of Missoula and Ravalli counties, in the State of Montana, praying for the enactment of legislation providing for the reclamation of the arid lands in those counties; which was ordered to lie on the table.

February 25.

In the House, by Mr. Lacey: Resolutions of the St. Paul Chamber of Commerce favoring storage reservoirs for the reclamation of arid lands. By Mr. Robinson, of Indiana: Petition of Advance Grange of Fremont, Ind., against government irrigation projects.

RECENT PUBLICATIONS.

Irrigation in the United States. By **FREDERICK HAYNES NEWELL**, Chief Hydrographer, U. S. Geological Survey. Pp. 566. Illustrated with 156 half tones and diagrams. New York: Thos. Y. Crowell & Co., 1902. Price, \$2 net; postage, 20 cents.

Thomas Y. Crowell & Company, of New York, have just issued a new book entitled "Irrigation in the United States." The author of this book is Mr. Frederick H. Newell, the well-known hydrographer in charge of the irrigation investigations of the Interior Department. The aim and scope of the book are well indicated in the opening paragraph of the first chapter, as follows:

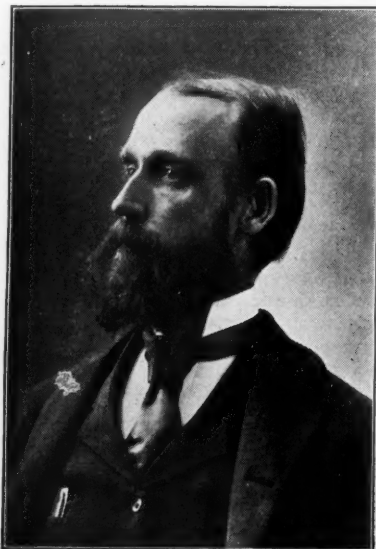
"Home-making is the aim of this book. The reclamation and creation there of fruitful farms, each tilled by its owner, is its object. The attainment of this end is sought by directing attention to the resources of our great unutilized public domain, in the hope that through a more complete knowledge of these and the methods of their utilization vigorous and wise action may supersede the present lax and improvident policy."

About half the book is devoted to the details of various methods of measuring streams and determining water supply, the storage and diversion of water, and its application to the land. All these are set forth in a manner very readable and instructive to the irrigator and the general public. The duty of water, both present and possible, is discussed. A chapter is devoted to underground waters, both surface and artesian, and another to methods of pumping.

The subject of irrigation law is discussed in a general way, and some possible improvements are indicated. The writer, however, believes that, although the laws of water distribution are nowhere ideal, the condition is not as bad as is represented by some extremists, and it is not necessary that irrigation development should await a complete revolution of irrigation law. The latter part of the book

is devoted to a more detailed discussion of the local conditions and possibilities in each state and territory.

Though the author is an ardent advocate of irrigation and sets forth vividly the possibilities of our arid public domain, there is a notable absence of exaggeration or partisan argument, nor is there any concealment of its weak points. The candid spirit that pervades the whole book is best illustrated in the chap-



Courtesy of Thos. Y. Crowell & Co.

MR. FREDERICK HAYNES NEWELL, AUTHOR OF "IRRIGATION IN THE UNITED STATES."

ter on "Advantages and Disadvantages of Irrigation," wherein the author discusses, among other points, the fertilizing effects of water, the silting of reservoirs, and the poisoning of the soil with alkali.

The work contains a great deal that is new and a great deal of old matter brought up to date and placed in a condensed and readable form logically classified, by an author who may be well classed as the most widely and thoroughly informed upon this subject of any living man.

The book is an attractive one of 566 pages, printed in new, clean, leaded long primer, and profusely illustrated with 62 half-tone plates and 94 text figures. It is hoped that it will be widely circulated, for we believe that a candid statement of the unvarnished facts, such as we have here, will have a profound influence in awakening thoughtful minds to the importance to our nation and our posterity of a broad national irrigation policy.

ARTHUR P. DAVIS.

New York State Fisheries, Forest, and Game Commission. Fifth Annual Report, 1899. Pp. 466. 114 illustrations.

The Fifth Annual Report of the New York State Fisheries, Forest, and Game Commission is an unusually handsome volume, containing a great deal of valuable information. Of special interest to the readers of **FORESTRY AND IRRIGATION** are the reports and contributed articles on forestry. These include the report of the Superintendent of Forests, Col. William F. Fox; "Some European Forest Scenes," by Dr. John Gifford; "Beginnings of Professional Forestry in the Adirondacks," by Dr. B. E. Fernow; "Forest Taxation," by Dr. C. A. Schenck; "Timber Product of the Adirondacks," and "Forest Fires in 1899," by Colonel Fox, and "Insects Injurious to Elm Trees," by E. P. Felt.

Of the many handsome illustrations in this volume, fourteen are colored plates. Altogether, this is an unusually valuable report.

Propagation of Forest Trees Having Commercial Value and Adapted to Pennsylvania. By GEO. H. WIRT, State Forester of Pennsylvania. Published by the Pennsylvania Department of Forestry.

A pamphlet of 38 pages, giving general instructions on the preparation of the forest

nursery and cultural directions on some seventy of the more important trees for planting in Pennsylvania. This is a very simple, concise treatment of the subject. Every page is crowded full of useful, though not new, information about the gathering, treatment, and planting of forest-tree seeds and the transplanting of seedlings. It is especially valuable on account of treating each species individually rather than as one of a group. Only in a few instances, as in the case of the oaks, are several species grouped together. While the author makes no claim of bringing forward new information, he has brought together from various sources some exceedingly useful information to forest planters. Through a state publication, the pamphlet has general application, and could well be distributed throughout the East and Middle West.

AMONG THE MAGAZINES

Woodland and Roadside is the name of a bulletin to be published quarterly by the Massachusetts Forestry Association. The first number, which was issued March 1, states that the purpose of *Woodland and Roadside* is "to keep the membership in touch with the activities of the organization." The opening number reflects great credit on the publication committee, and the cause of forestry will likely be greatly advanced in Massachusetts through this periodical.

The *Indian Forester* for February contains an interesting article on "Six Months in the Sudan," by C. E. Muriel, deputy conservator of forests.

The *World's Work* for March has an excellent article on "The Wonders of the American Desert," by Robert T. Hill, a well-known member of the U. S. Geological Survey.

"The Sugar Bush" is the subject of a seasonable article in *Country Life in America* for March.

The *Popular Science Monthly* for March has an interesting illustrated article on "The Palm Trees of Brazil," by Prof. John C. Branner.

Outing for March is unusually attractive, both in an artistic and a literary way.

"Irrigation as a National Wealth-maker," by Senator H. C. Hansbrough, and "What Irrigation is Doing in Arizona," by Arthur P. Davis, are two articles on irrigation published in the March number of the *National Magazine*.

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The large number of half-tone illustrations, maps, and diagrams are from official sources and, like the text, are trustworthy and satisfying.

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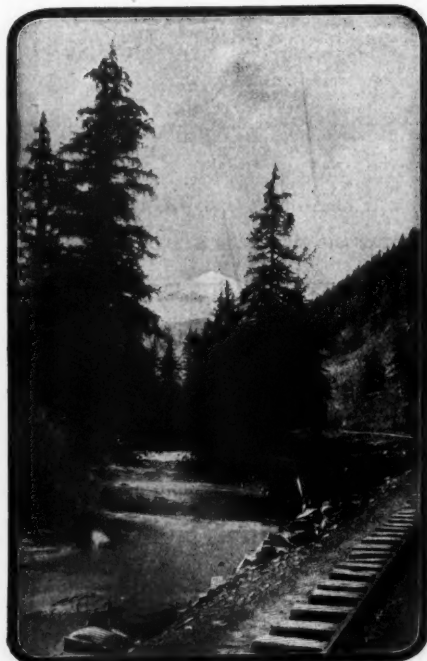
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